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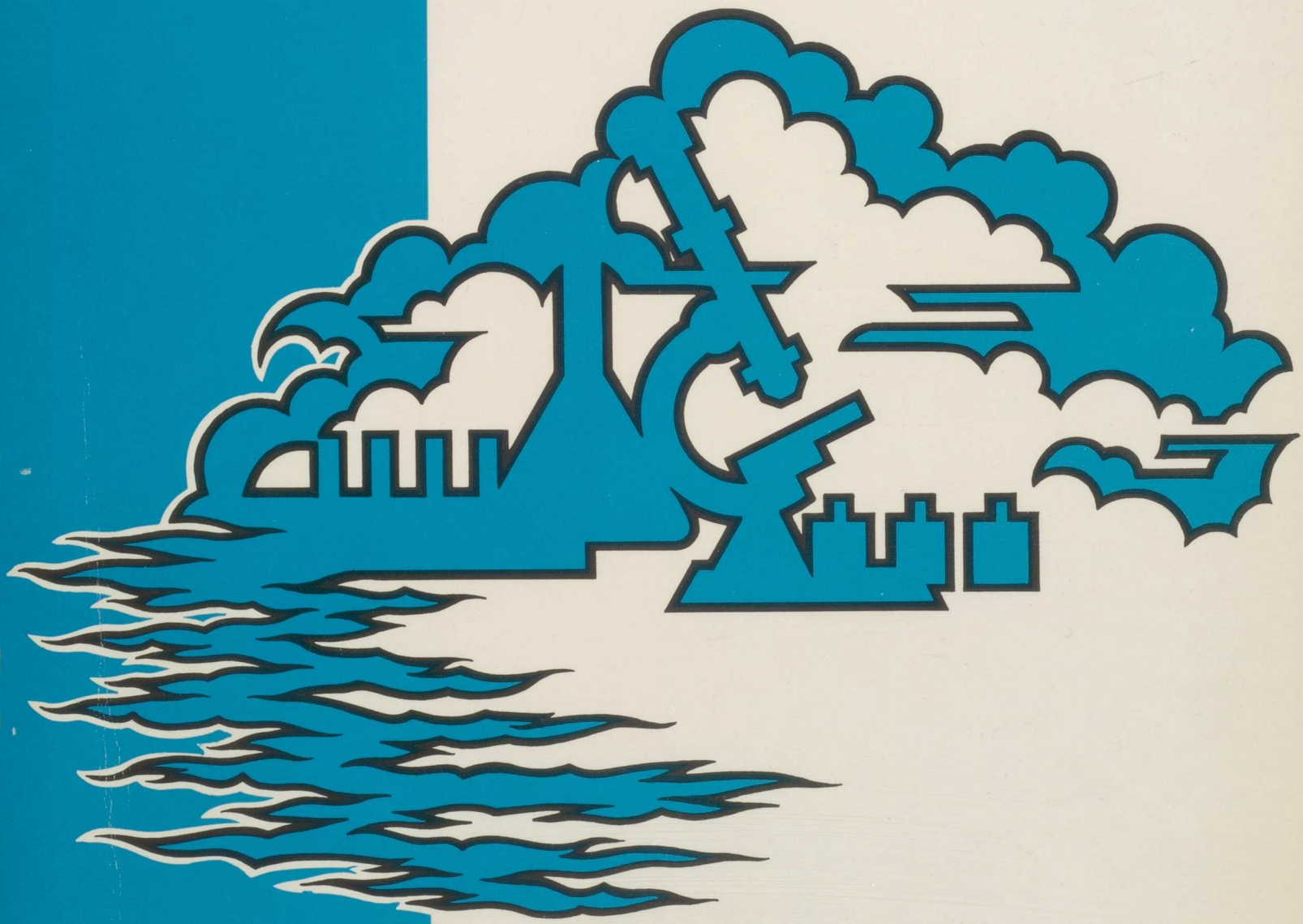
Canada-United States Research Programs Pertinent to the Water Quality of the Great Lakes: A Report to the International Joint Commission

Great Lakes Research Advisory Board

GREAT LAKES
RESEARCH ADVISORY BOARD



INTERNATIONAL JOINT COMMISSION

CANADA–UNITED STATES RESEARCH PROGRAMS PERTINENT TO THE WATER QUALITY OF THE GREAT LAKES

GREAT LAKES RESEARCH ADVISORY BOARD

CANADA–UNITED STATES RESEARCH PROGRAMS PERTINENT TO THE WATER QUALITY OF THE GREAT LAKES

A REPORT
TO THE
INTERNATIONAL
JOINT COMMISSION
JULY 1978

WINDSOR, ONTARIO

INTERNATIONAL JOINT COMMISSION

GREAT LAKES RESEARCH ADVISORY BOARD

June 1978

International Joint Commission
Canada and United States

Gentlemen:

The International Great Lakes Research Advisory Board has concluded its recent task of identifying research needs within the Great Lakes Basin and submits the following report on these activities.

Respectfully submitted,

A R LeFeuvre

Dr. A. R. LeFeuvre
Chairman
Canadian Section

D I Mount

Dr. D. I. Mount
Chairman
United States Section

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PREFACE

With the signing of the Canada-United States Great Lakes Water Quality Agreement in 1972, the responsibilities of the International Joint Commission (IJC) regarding future research activities on Great Lakes water quality were defined, together with recommendations to the Parties and to the State and Provincial governments. Under the Agreement, a Great Lakes Research Advisory Board was established with specific Terms of Reference to undertake these functions and responsibilities in support of the IJC.

The functions and responsibilities of the Research Advisory Board relating to Canadian and United States research activities concerning the water quality of the Great Lakes System were stated as:

(a) to review at regular intervals these research activities in order to:

  (i) examine the adequacy and reliability of research results, their dissemination, and the effectiveness of research results;

  (ii) identify deficiencies in their scope, and inadequacies in their funding and in completing schedules;

  (iii) identify additional research projects that should be undertaken;

  (iv) identify specific research programs for which international co-operation will be productive,

(b) to provide advice and consolidations of scientific opinion to the Commission and its boards on particular problems referred to the Advisory Board by the Commission or its boards;

(c) to facilitate both formal and informal international cooperation and coordination of research;

(d) to make recommendations to the Commission.

The Board, moreover, on its own authority may seek analyses, assessments, and recommendations from the professional, academic, governmental or intergovernmental groups about the problems of the Great Lakes water quality research and related research activities.

In implementing its Terms of Reference, the Board has utilized workshops on selected research topics, sponsored by several of its Standing Committees, to assess the state-of-the-art and to identify new areas for research. In addition, directives of current research programs and projects were compiled on behalf of the Board by the IJC Great Lakes Regional Office Secretariat for two consecutive years by soliciting "the Great Lakes scientific community" through the medium of questionnaires.

The Board's Research Needs Committee complemented these directives with a request for research needs of the same sector of the scientific community. Based on the response this Committee organized a workshop in March 1976 to recommend research priorities. These were published in the Research Advisory Board's report to the Commission on "Great Lakes Water Quality Research Needs, 1976." In its letter of transmittal the Board briefly outlined its strategy, recommending that the IJC forward the report to both the Canadian and United States governments for distribution to all state, provincial and federal agencies having research and development responsibilities relative to water quality in the Great Lakes System. The Board further recommended that the Commission advise these agencies that follow-up contact would be made with them by the Board to ascertain the degree of responsiveness of the total Canadian-United States programs to these research needs.

During September 1976 the Board established the Research Programs Committee as an executive committee to provide a focus for the assessment of ongoing research programs pertaining to the water quality of the Great Lakes System. This group provides a vehicle for the organization, analysis and documentation of Great Lakes water quality research activities from all pertinent sources for the Research Advisory Board; hence lending perspective to and identifying the scope of the relevant research activities. The present report represents the initial attempt of the Research Programs Committee to fulfill its obligations.

RESEARCH PROGRAMS COMMITTEE

ACKNOWLEDGEMENTS

The information contained in this report was made available by courtesy of the governments of Canada and the United States through the efforts of the Department of External Affairs Canada and the United States Department of State, respectively. The International Joint Commission's Great Lakes Research Advisory Board expresses its appreciation to all those governmental agency representatives involved for their cooperation and interest in contributing to this task.

The staff of the International Joint Commission's Great Lakes Regional Office aided in the preparation of this document.

INTRODUCTION

The Research Programs Committee, in meeting the obligations of its Terms of Reference, has initiated a program of inquiry designed to identify the scope and relevance of research programs currently operative in the United States and Canada, pertinent to the water quality of the Great Lakes. Central to the objectives of this inquiry is a comparison of the responsiveness of these activities to research issues and needs identified in "Great Lakes Water Quality Research Needs 1976," a recent report of the Research Advisory Board to the International Joint Commission. This report was forwarded to Governments of the United States and Canada with a request that it be distributed, together with a questionnaire, to all Governmental agencies having research and development responsibilities relative to water quality in the Great Lakes system.

The canvassing approach taken for the U.S. was initiated by the State Department through the Office of Canadian affairs, which requested the information from the various federal agencies. Requests to the bordering Great Lakes states were forwarded directly to the respective Governors by the International Joint Commission. For the Canadian programs, the survey was implemented by the Department of External Affairs which contacted the respective federal agencies and the Ontario Ministry of Intergovernmental Affairs.

Specific information requested from the agencies monitored included a listing of research program titles and descriptive narratives; a project title listing within each program; an agency evaluation of the responsiveness of its research program to the research needs identified in the "Needs" report; a program budget delineating total research effort as well as that specific to the basin and identification of appropriate agency representatives to be contacted for future inquiries. Details are given in Appendix E.

This report summarizes the results of this exercise and constitutes an effort of the Research Programs Committee to assess the adequacy and responsiveness of United States-Canadian research programs to research needs identified by the Research Advisory Board.

AGENCY RESEARCH PROGRAMS

INTRODUCTION

As a result of a Research Needs Workshop conducted in 1976 under the direction of the Research Needs Committee, 56 major research issues delineating some 236 research needs were identified. This listing encompassed a broad array of programs involving ecologic, technologic, social, economic and political considerations relating to Great Lakes water quality. The summary of the issues is given in Appendix G.

Agencies surveyed were requested to review these needs and relate them to their program objectives. The nature of the responses received varied widely ranging from sample listings of projects to detailed analyses as requested. In an effort to normalize the responses into a format that could be readily collated, the identified issues were recast by type of activity. This structure, shown in Tables 1-3, was deemed to be compatible with program organizations currently employed by several major research agencies. In reviewing the tables, the following issue summaries are appropriate.

- Ecological Issues basically deal with the development of methodologies, both chemical and biological, for the identification of potential contaminants; a characterization of their sources; a definition of their dynamics in the lake ecosystems (transport and reaction) and an assessment of ultimate environmental effects pertaining to aquatic communities and to human health.

  The contaminants in question are defined in the general sense and for specific constituents including: halogenated hydrocarbons, toxic elements, polychlorinated biphenyls (PCBs), organics, radionuclides, asbestiform minerals, domestic sewage, halogenated pesticides, polynuclear aromatic hydrocarbons, and pathogenic fungi, bacteria, and viruses.

- Technological Issues focus on the control of specific categories of pollution problems, including hazardous wastes, non-point source inputs, dredged materials, oil pollution, nutrients, and chemical spills. Attention is also directed to the development of improved technology for wastewater treatment with specific emphasis on unit processes for disinfection, sludge disposal, and land disposal of liquid effluents. Other issues addressed include the development of methodologies for defining cost-effective waste management schedules and the improvement of current technologies for water supply.

- Social-Economic-Political Issues are directed to the various social, political and legal considerations involved in the decision making

TABLE 1: RESEARCH CATEGORIES - ECOLOGICAL ISSUES AND NEEDS

I. WATER QUALITY PARAMETER IDENTIFICATION AND METHODS DEVELOPMENT

a. General: E 1 - all

b. Toxic Elements
   1. Toxics: E 3.2
   2. Asbestiform minerals: E 9.1

c. Organics
   1. Halogenated hydrocarbons: E 2.4
   2. Polychlorinated biphenyls: E 4.3
   3. Nuisance organics: E 11.1, 11.2
   4. Halogenated pesticides: E 20.4, 20.5
   5. Polynuclear armomatic hydrocarbons: E 22.1, 22.2

d. Microbial
   1. Domestic sewage: E 12.2, 12.3
   2. Pathogenic fungi, bacteria, viruses: E 26.1

II. SOURCE AND FATE OF CONTAMINANTS

A. Source Characterization

a. General

b. Toxic Elements
   1. Toxics: E 3.6
   2. Asbestiform minerals: E 9.1

c. Organics
   1. Halogenated hydrocarbons: E 2.3
   2. Polychlorinated biphenyls: E 4.1
   3. Halogenated pesticides: E 20.2
   4. Polynuclear aromatic hydrocarbons: E 22.3

B. Transport

a. General: E 7 - all

b. Toxic Elements: E 3.7, E 4.4

c. Organics: E 11.5

C. Reactions

a. General

b. Toxic Elements:

   1. Toxics: E 3.8
   2. Radionuclides: E 8 - all

c. Organics: E 2.5, 4.5, 6.1, 6.2, 6.3, 6.4, 20.5, 20.6, 22.4

III. ENVIRONMENTAL EFFECTS

A. Aquatic Communities and the Lake Ecosystem

a. Toxic Elements: E 3.3, 3.4, 3.5

b. Organics: E 2.2, 4.2, 11.4, 20.1, 22.5

c. Endangered Species: E 5 - all

d. Coastal Zone Effects: E 10 - all

e. Fisheries Management: E 16 - all

f. Biotic Interaction:
   1. System stress and response: E 18 - all
   2. Ecological models: E 21 - all
   3. Algal models: E 24

B. Health Effects

a. Toxic Elements: E 3.1, 9.2, 9.3

b. Organics: E 2.1, 4.6, 6.3

c. Geographic Patterns: E 13

d. Domestic Wastewaters and Microbial Pollution
   1. Domestic sewage: E 12.1
   2. Cancer: E 14
   3. Subclinical disease: E 19
   4. Pathogenic fungi: E 26.2

e. St. Louis Encephalitis: E 15

TABLE 2: RESEARCH CATEGORIES - TECHNOLOGICAL ISSUES AND NEEDS

I. CONTROL OF POLLUTANTS

a. Disinfection: Chlorine, Other: T 1

b. Hazardous Substances: T 2

c. Non-Point Source: T 3

d. Dredged Materials: T 5

e. Oil and Chemical Spills: T 8, T 11

f. Nutrients (point source): T 9

g. Land Disposal of Wastewater: T 12

h. Sludge Disposal: T 6

II. WASTEWATER UNIT PROCESS DESIGN AND MANAGEMENT: T 4, T 10

III. WATER SUPPLY UNIT PROCESS DESIGN AND MANAGEMENT: T 7

TABLE 3: RESEARCH CATEGORIES - SOCIO-ECONOMIC, POLITICAL ISSUES AND NEEDS

I.	Social Values	SEP 1
II.	Socio-Economic Guidelines	SEP 2
III.	Energy Impacts	SEP 3
IV.	Coastal Zone Management	SEP 4
V.	Impacts of Regulations	SEP 5, 12
VI.	Public Information	SEP 6
VII.	Institutional Arrangements	SEP 7
VIII.	Public Participation	SEP 8
IX.	Energy Sources	SEP 9
X.	Agency Coordination	SEP 10
XI.	Forecasting Techniques	SEP 11
XII.	Regional Delineation	SEP 13
XIII.	Fishing Potential	SEP 14
XIV.	Water Quality Legislation	SEP 15
XV.	Transportation	SEP 16
XVI.	Resource Pricing	SEP 17
XVII.	Recreation	SEP 18

processes pertinent to Great Lakes water quality. Emphasis is placed on institutional arrangements, public participation and effective communication. Other concerns pertain to the development of methodologies to assess social and economic impacts associated with water quality protection and improvement. Specific problem areas include: energy, manufacturing, transportation, fisheries, and recreation.

SURVEY SUMMARY

Program descriptions developed from the various agency responses are given in the following sections. Raw data (Appendix E: example) together with individual project listings acquired in the canvass, currently are on file with the IJC Great Lakes Regional Office Secretariat. Attempts have been made to interpret these responses in light of the needs and the Terms of Reference of the Research Advisory Board. Assignments of budget and research commitments to specific issues were derived from Committee input as well as from direct agency response. Many of the programs which were surveyed include research efforts external to the Great Lakes Basin. Interpretations have been made as to the relevancy of these programs to Basin needs, as well as to the potential for transferability of research results to the solution of Basin problems.

A listing, by code, of the agencies contacted is presented in Table 4. A summary of agency participation by program activity is given in Tables 5 through 7, with a more detailed alignment according to specific research issues outlined in Appendix H. Highlights of specific research objectives by agency are detailed in the program narrative section.

Examination of Tables 5 through 7 as well as Appendix H reveals a marked level of agency participation and mutual interest in a significant number of the ecological and technical research issues identified by the Research Advisory Board. A similar emphasis is not evident with regard to issues pertaining to social, economic and political concerns. It should be understood that although these summaries provide a perspective as to the international scope of ongoing research activity, they are inconclusive as to the intensity of commitment to a given area. The nature of the budget data received precludes such an assessment.

With respect to ecological concerns, a concentration of agency interest is apparent in a number of critical issue areas including programs of study related to the identification, quantification, fate, and environmental effects of potentially toxic elements, chlorinated hydrocarbons, new generation pesticides, polychlorinated biphenyls, as well as to other trace organics and industrial toxcis. Emphasis is given to the identification and quantification of potential health effects (carcinogenicity and mutagenicity) associated with these entities. In addition, significant attention is directed to the characterization of processes which transport contaminants within the Great Lakes, and to the development and verification of models to simulate ecosystem dynamics. The primary focus of the international research effort centers on issues described under Ecol 2, 3, 4, 7, 20, and 24.

TABLE 4: LIST OF AGENCIES BY CODE

ACRONYMS USED IN THE AGENCY PARTICIPATION MATRIX (TABLES 5-7)

Canadian Federal Government

AC	Agriculture Canada
AES	Atmospheric Environment Service, Fisheries and Environment
CCIW	Canada Centre for Inland Waters, Burlington, Ontario (Fisheries and Environment)
CMHC	Central Mortgage and Housing Corporation
CWD	Canadian Wildlife Directorate, Environmental Management Service, Fisheries and Environment
CMHC	Central Mortgage and Housing Corporation
EMS	Environmental Management Service, Fisheries and Environment
EPS	Environmental Protection Service, Fisheries and Environment
F&Envt.	Fisheries and Environment Canada
FMSN	Fisheries and Marine Service, Fisheries and Environment (National)
FMSO	Fisheries and Marine Service, Fisheries and Environment (Ontario Region)
GLFRC	Great Lakes Forest Research Centre, Sault Ste. Marie, Ontario, Environmental Management Service, Fisheries and Environment
IWD	Inland Waters Directorate (Ontario Region), Environmental Management Service
NHW	Health and Welfare Canada
WTC	Wastewater Technology Centre, Burlington, Environmental Protection Service, Fisheries and Environment

Ontario Government

OH	Ontario Hydro
OMAF	Ontario Ministry of Agriculture and Food
OMOE	Ontario Ministry of the Environment
OMH	Ontario Ministry of Health
OMNR	Ontario Ministry of Natural Resources

United States Government

ARS	Agriculture Research Service, Department of Agriculture
COE	United States Army Corps of Engineers
DA	Department of the Army
DAG	Department of Agriculture
DOC	Department of Commerce
DOI	Department of the Interior
DON	Department of the Navy
DOT	Department of Transportation
EPA	Environmental Protection Agency
ERDA	Energy Research and Development Administration
FWS	Fish and Wildlife Service, Department of the Interior
GLERL	Great Lakes Environmental Research Laboratory, NOAA, Department of Commerce
NSF	National Science Foundation
OCZM	Office of Coastal Zone Management, NOAA, Department of Commerce
OWRT	Office of Water Research and Technology, Department of the Interior
SG	Office of Sea Grant, NOAA, Department of Commerce
USCG	United States Coast Guard, Department of Transportation
USGS	United States Geological Survey, Department of the Interior

TABLE 5. ECOLOGICAL ISSUES: SUMMARY OF AGENCY PARTICIPATION

	UNITED STATES FEDERAL GOVERNMENT																CANADIAN FEDERAL GOVERNMENT										ONTARIO GOVERNMENT				
PROBLEM CATEGORY	DA COE	DAG ARS	GLERL	DOC OC&M	SG	OWRT	DOI FWS	USGS	DON DON	DOT USCG	EPA EPA	ERDA ERDA	NSF NSF	AC AC	CHMC CHMC	AES AES	EMS CCIW	IWD	GLFRC	CWD	EPS EPS	FMSN	FMS FMSO	NHW NHW	OMOE	OMAF	OMH	OMNR	OH		
I. Water Quality Parameter Identification and Methods Development																															
a. General					X	X							X	X			X	X					X		X						
b. Toxic Elements					X	X	X				X		X	X		X	X		X			X	X	X		X				
c. Organics					X	X		X			X		X			X	X	X	X		X		X		XX		XX				
d. Microbial											X						X														
II. Source and Fate of Contaminants																															
A. Source Characteristics																															
a. General			X																												
b. Toxic Elements		X			X						X	X	X			X		X	X						X		X				
c. Organics		X			X						X		X			X		X	X		X		X		X		X				
d. Microbial											X																				
B. Transport																															
a. General		X	X		X	X		X			X	X				X	X		X		X		X	X		X					
b. Toxic Elements					X	X		X			X	X	X						X											X	
c. Organics											X		X				X				X									X	
d. Microbial											X																				
C. Reaction																															
a. General																															
b. Toxic Elements		X			X	X	X				X	X	X				X					X	X	X		X					
c. Organics		X			X		X				X		X			X	X			X	X	X	X	X		X					
d. Microbial											X																				

TABLE 5. ECOLOGICAL ISSUES: SUMMARY OF AGENCY PARTICIPATION

PROBLEM CATEGORY	UNITED STATES FEDERAL GOVERNMENT																CANADIAN FEDERAL GOVERNMENT									ONTARIO GOVERNMENT				
	DA COE	DAG ARS	DOC GLERL	DOC OC&M	DOC SG	DOC OWRT	DOI FWS	DOI USGS	DON DON	DOT USCG	EPA EPA	ERDA ERDA	NSF NSF	AC AC	CMHC CMHC	AES AES	EMS CCIW	EMS IWD	EMS GLFRC	EMS CWD	EPS EPS	FMS FMSN	FMS FMSO	NHW NHW	OMOE	OMAF	OMH	OMNR	OH
III. Environmental Effects																													
A. Aquatic Communities and the Lake Ecosystem																													
a. Toxic Elements					X		X	X			X	X					X			X		X	X		X	X			
b. Organics					X		X				X						X			X		X	X			X			
c. Endangered Species							X												X										
d. Coastal Zone Effects			X			X	X				X	X					X						X						
e. Fisheries Management					X		X															X	X						
f. Biotic Interaction			X		X	X	X				X	X					X			X		X	X			X			
B. Health Effects																													
a. Toxic Elements					X	X					X		X	X			X			X			X	X	X	X			
b. Organics											X		X							X		X		X		X			
c. Geographic Patterns																													
d. Domestic Wastewaters & Microbial Pollution						X					X		X				X												
e. St. Louis Encephalitis														X															

TABLE 6. TECHNOLOGICAL ISSUES AND NEEDS: SUMMARY OF AGENCY PARTICIPATION

PROBLEM CATEGORY	UNITED STATES FEDERAL GOVERNMENT																		CANADIAN FEDERAL GOVERNMENT									ONTARIO GOVERNMENT				
	DA	DAG	DOC				DOI			DON	DOT	EPA	ERDA	NSF	AC	CHMC	AES		EMS				EPS		FMS		NHW				
	COE	ARS	GLERL	OC&M	SG	OWRT	FWS	USGS	DON	USCG	EPA	ERDA	NSF	AC	CHMC	AES	CCIW	IWD	GLFRC	CWD	EPS	FMSN	FMSO	NHW	OMOE	OMAF	OMH	OMNR	OH
I. Control of Pollutants																															
a. Disinfections						X					X		X		X		X				X				X						
b. Hazardous Substances						X					X				X		X				X				X						
c. Non-point Source		X				X		X			X			X	X	X	X				X								X		
d. Dredgings	X																X														
e. Oil and Chemical Spills					X					X	X		X																		
f. Nutrients (Point Source)						X					X						X				X				X						
g. Land Disposal of Wastewater		X				X					X		X								X										
h. Sludge Disposal		X				X					X		X	X	X						X										
II. Wastewater Unit Process Design and Management						X				X	X					X					X				X						
III. Water Supply Unit Process Design and Management						X					X						X								X						

TABLE 7. SOCIO-ECONOMIC, POLITICAL ISSUES AND NEEDS: SUMMARY OF AGENCY LEGISLATION

PROBLEM CATEGORY	UNITED STATES FEDERAL GOVERNMENT																CANADIAN FEDERAL GOVERNMENT								ONTARIO GOVERNMENT					
	DA COE	DAG ARS	DOC GLERL	DOC OC&M	DOC SG	DOI OWRT	DOI FWS	DOI USGS	DON DON	DOT USCG	EPA EPA	ERDA ERDA	NSF NSF	AC AC	CHMC CHMC	AES AES	EMS CCIW	EMS IWD	EMS GLFRC	EMS CWD	EPS EPS	FMS FMSN	FMS FMSO	NHW NHW	OMOE	OMAF	OMH	OMNR	OH	
I. Social Values						X												X												
II. Socio-Economic Guidelines						X												X												
III. Energy Impacts				X		X							X					X			X									
IV. Coastal Zone Management				X																										
V. Impacts of Regulations						X												X			X									
VI. Public Information			X	X		X												X												
VII. Institutional Arrangements																														
VIII. Public Participation					X													X												
IX. Energy Sources																														
X. Agency Coordination																		X												
XI. Forecasting Techniques														X																
XII. Regional Delineation																														
XIII. Fishing Potential																														
XIV. Water Quality Legislation					X								X																	
XV. Transportation																														
XVI. Resource Pricing																														
XVII. Recreation					X	X																								

Programs of research currently exist which address each of the technological areas identified by the Board. Primary areas of mutual interest relate to the characterization and control of non-point source emissions; sludge handling, utilization, and disposal; land disposal of liquid effluents including potential associated health and environmental effects; dredged material disposal; alternative methods for disinfection, and the development of improved and new technologies for the removal of trace contaminants and toxics.

The scope of effort pertaining to identified socio-economic and political issues appears limited. Little program focus or coordination is evident, with studies being scattered and directed to specific research topics. Emphasis is centered on studies relating to the social-economic-environmental-energy impacts of development and to the adequacy of information for the public and the policy maker as identified under issue numbers SEP 3 and 6.

The aggregated research programs which were monitored identify a research budget allocation of approximately 100 million dollars with some 13 to 15 million dollars committed to efforts specific to the Great Lakes. Programs addressing ecological and technological issues account for some 98 percent of the aggregated budget with an allocation of approximately 50 percent to each of the issue areas. The remaining 2 percent is directed to the social-economic-political area.

DISCUSSION

This survey has provided a perspective on the scope of research activity currently operative in Canada and the United States which is pertinent to the water quality of the Great Lakes. In terms of general program objectives and research thrusts, it has been demonstrated that current efforts are responsive to major ecological and technological research issues identified as critical by the Research Advisory Board. Moreover, the concentration of mutual agency interest in issues previously highlighted suggests significant opportunities to foster both formal and informal international cooperation. Such cooperation would be particularly appropriate to research endeavors exogenous to the basin that produce results that can be transferred. Primary candidate areas include programs focused on the identification of health and environmental effects of toxics and trace organics and the development of technology for the control of such contaminants.

The present study provides an overview of the current international research posture with respect to the Great Lakes' water quality. However, the method of assessment used in this study was inadequate for defining deficiencies in scope, adequacy and reliability of research results, and inadequacies in funding for specific research program areas. Future exercises should concentrate on focused research issues with an emphasis on these critical elements of program review. As a consequence of this initial effort a mechanism of interagency communication and contact has been established to implement this approach.

PROGRAM NARRATIVES - CANADA

CANADIAN FEDERAL GOVERNMENT

1. AGRICULTURE

2. CENTRAL MORTGAGE AND HOUSING CORPORATION

3. FISHERIES AND ENVIRONMENT

   A. Atmospheric Environment Service

   B. Environmental Management Service

      i. Canada Centre for Inland Waters, Burlington

      ii. Inland Waters Directorate, Ontario Region

      iii. Great Lakes Forest Research Centre, Sault Ste. Marie, Ontario

      iv. Canadian Wildlife Directorate, Wildlife Management Branch, Ontario Region, Burlington

   C. Environmental Protection Service

   D. Fisheries and Marine Service

      i. National

      ii. Ontario Region

4. HEALTH AND WELFARE

ONTARIO GOVERNMENT

5. MINISTRY OF AGRICULTURE AND FOOD

6. MINISTRY OF THE ENVIRONMENT

7. MINISTRY OF HEALTH

8. MINISTRY OF NATURAL RESOURCES

9. ONTARIO HYDRO

1. AGRICULTURE CANADA

a. Program Narrative

Several agency programs are related to the research needs for improving Great Lakes water quality. These include: the handling and disposal of animal and crop wastes; pesticide management; plant nutrients; non-agricultural pollutants; cereal crop objectives and beef cattle objectives.

The Agriculture Canada Operating Grants and Extra-Mural Research Grants Program also supports research on systems modelling in integrated pest management as well as the DREAM program, i.e. research, development and evaluation in agricultural mechanization.

Directly related to the Great Lakes Basin is Agriculture Canada's contribution to the Agricultural Watershed Studies, conducted by Task Group "C" of the International Joint Commission's International Reference Group on Great Lakes Pollution from Land Use Activities (PLUARG).

b. Research Issues Addressed

The above-noted research programs address at least one issue of the three research categories identified.
ECOL 1, 3, 3.1, 3.2, 15; TECH 3, 3.1, 6; SEP 11

c. Agency Comment

No comments on the adequacy of the "Research Needs Report" were made. The agency selected research programs appropriate to the above report.

d. Research Program Budgets

(a) Total Water Research Budget ($1,000); not available
(b) Research Relevant to the Great Lakes Basin ($1,000); 2,846 (FY 76/77)
(c) Research Specific to the Great Lakes Basin ($1,000); 350 (FY 76/77)

2. CENTRAL MORTGAGE AND HOUSING CORPORATION (CMHC)

a. Program Narrative

This federal agency operates a Municipal Infrastructure Technical Research Program in conjunction with the Municipal Sewage Collection and Treatment Technology (SCAT) Interdepartmental Committee. Major areas of research are supported under this program.

Four relevant topics listed within this program include:

- improved collection systems for the control and/or treatment of storm sewer discharges and combined sewer overflows, covered by 6 SCAT/CMHC projects, and funded largely through the Canada-Ontario Agreement (COA) with Fisheries and Environment Canada commitment;

- research on upgrading wastewater treatment plant performance is addressed by 6 earlier Great Lakes eutrophication studies, supported by COA. From the studies also have come demonstration projects for phosphorus and nitrogen removal, alternatives to chlorine disinfection and CMHC's development of wastewater reclamation by the CANWEL dual purpose water supply system;

- ultimate residue management involving improved methods for safely disposing of increasing quantities of polluted sewage treatment plant residual sludge and liquid wastes is contemplated. Other investigations include the use of sludge as an edible crop fertilizer and the development of technology for recycling and resource recovery from municipal waste residues, involving the City of London, Ontario;

- small sewage disposal systems research is underway to improve the operation of septic tanks in acceptable localities in addition to the evaluative studies on small waste treatment systems as alternatives to septic tanks, with support from Fisheries and Environment Canada.

b. Research Issues Addressed

Only technological issues have been investigated by this agency. TECH 1, 2, 3, 4, 6, 10

c. Agency Comments

No specific comments were received regarding the Board's document but research issues listed were correlated as far as possible with the few major aspects of the CMHC program. Both supporting and cooperative agency listings were provided in the CMHC response. It should also be noted that the SCAT Research Committee comprises technical experts to advise CMHC and other federal agencies, as appropriate, regarding the funding of research, development and demonstration of municipal sewage collection and treatment technology.

d. Research Program Budgets

(a) Total Water Research Budget ($1,000); 356.836 (FY 76); other fiscal support ($1,000); 80.00 (FY 76)

(b) Research Relevant to the Great Lakes Basin ($1,000); this program, and its sub-programs, is generally applicable to the Great Lakes Basin problems. Also, no man year allocations were made by this agency, due probably to the involvement of co-operating and supporting agencies

(c) Research Specific to the Great Lakes Basin ($1,000: not identified

3. FISHERIES AND ENVIRONMENT CANADA (F&Envt.)

A. Atmospheric Environment Service (AES)

a. Program Narrative

This service supports three programs specifically related to Great Lakes Water Quality. The atmospheric pathway and process studies program investigates atmospheric transport, transformation, diffusion and deposition processes for modelling purposes and, in part, with relevance to pollutant exchanges between the atmosphere and lakes. Results, available on a continuing basis, will be used by the scientific community and the pollution control enforcement agencies.

Atmospheric sampling and analytical methodology is under study in the second program, being relevant to the measurement of atmospheric pollutants interacting with the lake environment. The revised techniques will be adapted to routine monitoring and surveillance programs performed by the appropriate agencies and made available to the scientific community.

The program for air and precipitation chemistry monitoring involves measurements to determine atmospheric composition and pollutant concentration and deposition on the Great Lakes. The results will be made available to the Great Lakes scientific community and the monitoirng and surveillance agencies.

b. Research Issues Addressed

Only ecological and technological issues and needs are addressed by this agency.
ECOL 2.5, 3.2, 3.6, 4.1, 4.3, 7.1, 7.5, 11.1, 20.2, 20.5; TECH 3.1

c. Agency Comments

No AES programs are specifically related to Great Lakes Water Quality concerns, hence the closest relevant activities are listed and a passing reference made to the Board's report. It is difficult to identify which activities are conducted in Great Lakes Basin facilities.

d. Research Program Budgets

(a) Total Water Research Budget ($1,000); none - see note below
(b) Research Relevant to the Great Lakes Basin ($1,000); 140 & 3.0 MY (FY 76); 155 & 3.0 MY (FY 77)
(c) Research Specific to the Great Lakes Basin; none

N.B. No "water research program" per se exists for this agency but the selected activities, above, each represent approximately 15% of the programs described.

B. Environmental Management Service (EMS)

i. Canada Centre for Inland Waters, Burlington, Ontario, (CCIW)

a. Program Narrative

The Canada Centre for Inland Waters has several research programs, projects and studies specific to the Great Lakes, supported by the Environmental Management Service. These programs are:

- water quality criteria, providing an understanding of the processes and pathways of substances and organisms in the aquatic environment as a basis for developing water quality criteria for water quality objectives. This program will aid the agency in meeting the obligations of the Canada - U.S. Great Lakes Water Quality Agreement, the Environmental Assessment Act and the Canada Water Act; the results being utilized for the development and institution of water quality criteria by both Canadian and U.S. regulatory agencies. Projects and studies covered include: eutrophication, microbiological indicators, the chemistry of natural waters and investigations of toxic substances.

- advanced methodologies development for new and more efficient sampling and analytical methods for the many new and exotic substances in the environment. This agency program is designed to further monitoring and surveillance of water quality under the Great Lakes Water Quality Agreement (IJC Great Lakes Surveillance and IJC Pollution from Land Use Activities Reference Group activities) and the Canada Water Act, the results being used by resource managers and regulatory agencies. Projects and studies include the development of methodology for: analysis and instrumentation to identify and quantify contaminants in the total aqueous system; spectro-optical sensing for water quality and limnology applications, both remote and in situ, and numerical modelling of the physical, chemical and biochemical systems of large lakes for their management.

- aquatic regime studies to gain an understanding of the environment and its variability under normal regime for better management protection. Development of baseline data against which to compare cultural impact and understanding of natural processes affecting man's use of the aquatic system. Results will be utilized by resource managers. Projects and studies include: geochemical cycles characterizing natural background conditions - e.g. nearshore conditions and predictive modelling development for large lakes.

- regime distortion studies to provide the basis for predictive models of environmental responses to regime distortions. Emphasis is on specific major industries of federal interest, or of particular industrial-urban complexes, or of specific material. Results will be used for resource management. Projects include: the environmental impact from energy development and predictive model development in lake systems regarding chemical and material fluxes, atmospheric loading and river response to pollutants.

- urban water resources to study novel water treatment technology and urban drainage systems in order to aid in solving problems of population growth in urban areas. Resource management decisions will be based on the results to attain improved water quality. Projects involve research on different techniques for treating potable waters.

- integral basin studies to acquire information on entire basin systems for integration to obtain the relationship among environmental parameters within a complete basin. This represents the major commissioned basin studies such as those of the IJC Upper Lakes Reference Group. The results will be available to resource managers.

- urban hydraulics and water quality to develop accurate, quantitative models of runoff. The problem of pollution of receiving waters from urban storm water runoff is increasing. Demands are growing to provide an increased capability to assess the effects of urbanization on natural drainage systems and on lake pollution. Again, the results obtained will be used by resource managers.

b. Research Issues Addressed

The ecological issues are extensively covered, the technological to a lesser extent and the societal, economic and political; not at all.
ECOL 1, 1.1, 1.2, 1.3, 1.4, 2, 2.4, 2.5, 3, 3.2, 3.3, 3.6, 3.8, 4, 4.2, 4.3, 6, 6.2, 7, 7.1, 7.2, 7.3, 7.4, 7.5, 8, 8.1, 9, 9.1, 9.4, 10, 10.1, 10.2, 11, 11.1, 11.2, 11.3, 11.5, 12, 12.2, 12.3, 20, 20.3, 20.4, 20.5, 24, 24.6, 25, 25.2, 26.1; TECH 1, 1.2, 2, 2.1, 3, 3.1, 3.2, 5, 5.2, 7, 7.2, 9, 9.1

c. Agency Comments

No comments on the adequacy of the "Research Needs Report" were made but the agency identified research programs appropriate to the report issues and needs. In the agency response, funding is given as "that required to operate those studies relevant to the identified RAB need." Moreover, the degree of relevance of agency studies to these issues and needs has not been indicated.

d. Research Program Budgets

(a) Total Water Research Budget ($1,000); not determined
(b) Research Relevant to the Great Lakes Basin ($1,000); not differentiated
(c) Research Specific to the Great Lakes Basin ($1,000); not differentiated

N.B. Total (a) and (b) is $15,863. and 636.9 MY, respectively.

ii. Inland Waters Directorate (Ontario Region)

a. Program Narrative

- The Ontario Region of the Environmental Management Service has several programs of relevance in the Inland Waters Directorate's Social Sciences Division and in the Water Planning Branch, respectively.

The Social Sciences Division lists three programs, as follows:

- Socio-Economic Studies - IJC support. This research program is directed toward IJC concerns and covers the social sciences, economic and legal aspects. User groups of the results will include: the IJC, governmental and private sector environmental groups, the general public and special interest groups. The program supports five projects including the social costs of environmental contaminants, economic impacts of water pollution abatement and demographic aspects of land use activities - derived pollution, in addition to an inventory of land use in the Canadian Great Lakes Basin.

- Socio-Economic Studies and Modelling. This program, focused on the Great Lakes and its Basin, provides socio-economic data for the management of water resources to maximize society's welfare on an integrated biological and social basis. The results, published on a continuing basis, will be available to the IJC, government and

private sector environmental groups, the general public and to special interest groups. Four projects supported involve socio-economic modelling, inventories of toxic substances and both social and management studies.

- Public Participation and Education. The program will develop files on public attitudes and behaviour regarding the environment and obtain an understanding of their origin and modification. The provision of ecosystem resource material for educational institutes and mass media is an important objective in this Great Lakes-oriented activity. Availability of the results depends upon project completion and they will be used by the IJC, the general public, special interest groups and public educational institutes. The sole project on environmental awareness is supported under this program.

  Only one program is noted for the Water Planning and Management Branch; that on Great Lakes Levels and Ice Formation Forecasting. The results, available monthly for water levels and ice conditions every two weeks, are used by Great Lakes Regulation Boards and Shipping and Electrical Power Generation interests.

b. Research Issues Addressed

These research programs address only issues in the ecological and social, economic and political categories. The following allocation has been made by the Research Programs Committee. ECOL 1.3, 2.3, 3.6, 4.1, 11.2; SEP 2.2, 3, 3.1, 3.7, 5, 6, 6.1, 6.2, 8, 10.4, 10.5

c. Agency Comment

No comments on the adequacy of the "Research Needs Report" were made.

d. Research Programs Budgets

(a) Total Water Research Budget ($1,000); not available
(b) Research Relevant to the Great Lakes Basin ($1,000); indistinguishable from
(c) Research Specific to the Great Lakes Basin ($1,000); 148.9 & 4.6 MY (FY 76); 208.7 & 5.6 MY (FY 77)

iii. Great Lakes Forest Research Centre, Sault Ste. Marie, Ontario

a. Program Narrative

The Great Lakes Forest Research Centre's Environmental Forestry program is part of the Environmental Management

Service's National program on Forest Management and Conservation. The program is concerned essentially with the collection of basic information and systematic evaluation of the impact of various cultural activities, such as forest harvesting practices, long range airborne industrial emissions and linear construction, on environmental deterioration in discrete forest ecosystems. The results, available from mid-1978 onwards, will be used by the IJC and its Water Quality Agreement Committees, Canadian federal and Ontario government resource agencies and concerned interest groups. One project, Environmental Impact Assessment in Forest Ecosystems, is supported by this program.

b. Research Issues Addressed

The research program only addresses ecological issues. The following allocation has been made by the Research Programs Committee.
ECOL 3, 3.6, 3.7, 4.1, 4.4, 5, 7, 7.1, 7.5, 11, 22

c. Agency Comment

No comments on the adequacy of the "Research Needs Report" were made.

d. Research Program Budgets

(a) Total Water Research Budget ($1,000); not available
(b) Research Relevant to the Great Lakes Basin ($1,000); see (c), below
(c) Research Specific to the Great Lakes Basin ($1,000); 12 & 2 MY (FY 76); 25 & 3 MY (FY 77)

iv. Canadian Wildlife Directorate, Wildlife Management Branch (Ontario Region, Burlington)

a. Program Narrative

The susceptibility of wildlife to toxic substances provides early warning of serious environmental contamination. Thus, this agency's program "Effects of Contaminants on Wildlife" for research on toxic substances in the Great Lakes, constitutes an important part of the IJC related Great Lakes Surveillance Program at the Canada Centre for Inland Waters (CCIW), Burlington. Researchers at the analytical chemistry facilities at CCIW have collaborated with those in Ottawa in these studies and reports are published upon their completion. Four projects are supported by this program, covering the identification and fate of toxic substances, especially organochlorine contaminants, in (fish-eating) herring gull tissues and

eggs. Egg shell quality and productivity will be studied in addition to an investigation of chromosome abnormalities.

b. Research Issues Addressed

Only ecological issues are addressed in this program. The following allocation has been made by the Research Programs Committee.
ECOL 3, 3.3, 4, 7, 11.1, 20, 20.3, 21, 22, 22.2, 22.3, 25, 25.2

c. Agency Comment

No comments were made on the adequacy of the "Research Needs Report."

d. Research Program Budgets

(a) Total Water Research Budget ($1,000); not available
(b) Research Relevant to the Great Lakes Basin ($1,000); see (c) below
(c) Research Specific to the Great Lakes Basin ($1,000); 100 & 3 MY (FY 76); 100 & 3 MY (FY 77)

C. Environmental Protection Service (EPS)
Wastewater Technology Centre, Burlington

a. Program Narrative

- Two programs are supported by this agency which relate to Great Lakes Water Quality and are concerned essentially with municipal and industrial wastewater treatment processes and facilities.

- Many of these activities are undertaken in collaboration with another agency, e.g. Central Mortgage and Housing Corporation (CMHC)/Sewage Collection and Treatment Technology (SCAT) Research Committee or under the Canada-Ontario Agreement (COA). In addition to EPS projects awarded to contractors, others are funded under the Development and Demonstration of Pollution Abatement Technology (DPAT) program.

- The Municipal Waste Treatment (COA) Program caters to the Municipal Sector. Six projects are supported, two by the COA and three by the CMHC/SCAT Research Committee. These cover: an inventory of specific pollutants; ozone disinfection; air flotation clarification; bio-nitrification and denitrification; and "ultimate" disposal systems for small communities.

- In addition, the Municipal Waste Treatment (COA) - Sludges - program addresses sludge disposal. Seven projects are supported under the Canada-Ontario Agreement: Ontario's sludge disposal

practices; chemical sewage sludges; disposal on agricultural land; a manual for sludge dewatering; monitoring of sludge disposal sites for hazardous chemicals; and incineration practice.

- The Industrial Waste Treatment Program applies to several industries, viz. the Mining, Mineral & Metallurgical Industry; the Food and Allied Industries; Petroleum and Industrial Organic Chemicals; the Inorganic Chemical Industry; and Paper, Pulp and Allied Products. Eight projects are supported: waste carbon sources for bio-denitrification of industrial wastes; leachability of radioactive products (mine tailings); physico-chemical treatment of mining effluents; "ultimate" disposal of industrial waste residues; rotating biological contactor design criteria; physico-chemical denitrification of industrial wastes; physico-chemical removal of Ra^{226} from mill effluents. Also, an industrial sludge dewatering project is supported by the program.

b. Research Issues Addressed

The agency research programs address largely technological issues, with the exception of one ecological issue, as allocated in the response. The Research Programs Committee has made additional allocations of issues and needs in all three categories for projects awarded under contract by EPS.
ECOL 2.5, 4.1, 17, 20.2, 20.6; TECH 1, 1.6, 2.2, 3.1, 4, 4.1, 4.2, 4.3, 4.4, 6, 6.2, 6.3, 9, 10.1, 12.2; SEP 3.5, 5.1.

c. Agency Comment

No comments were made on the adequacy of the "Research Needs Report."

N.B. Most of the above-noted research activities are conducted in Great Lakes regional facilities.

d. Research Programs Budgets

(a) Total Water Research Budget ($1,000); not available, but total Wastewater Technology Centre budget is $327.59 (FY 77/78)
(b) Research Relevant to the Great Lakes Basin ($1,000); 305.726 and 22.05 MY (FY 77/78), i.e. 93.35% of total budget
(c) Research Specific to the Great Lakes Basin ($1,000); not differentiated

D. Fisheries and Marine Service (FMS)

i. National

a. Program Narrative

- The national research activities on freshwater constitute those agency programs in the 5 regions of Canada, excluding the Ontario Region which is reported elsewhere (see ii, below). The Freshwater Institute (FWI), Winnipeg, Manitoba, and the St. Andrews Biological Station, (St.A.), St. Andrews, New Brunswick, are the only agency establishments outside Ontario conducting freshwater research. The 6 relevant programs are reported here.

- The Biological Methodology Program (FWI) conducts interdisciplinary research to develop bioassay methodology for screening hazardous chemicals and to determine the effects of toxic chemicals and complex wastes on aquatic life. Results will be used by research establishments, private industry and pollution control agencies in assessing the toxicological significance of known or suspected "Problem" chemicals. Projects cover the biochemistry, neurochemistry, behaviour and histopathology of fish.

- Experimental Limnology (FWI). Whole lake ecosystems are experimentally manipulated to provide detailed understanding, background and guidelines for the control of environmental problems due to eutrophication, acid precipitation, radionuclides, heavy metals and forest management practices. The results, valuable for developing and refining water quality objectives and identifying control strategies, would be used by resource managers and pollution control agencies as well as by the private sector.

- Freshwater and Anadromous Fish Research-Toxicology (St.A.). The research program covers the effects and fate of toxic chemicals in the aquatic environment, including investigation of methods to identify and measure effects using traditional bioassay and tissue culture techniques. The results of these studies on the Atlantic Salmon can be applied to the identification and investigation of contaminants in Great Lakes species. User groups would include pollution control and natural resource management agencies in addition to the private sector. Projects include research on both biological and chemical methodology for contaminant effect assessment; chemical structure/environmental effect relationships; and cell culture experiments.

- Chemical Methodology (FWI). Both fundamental and applied research is supported by this program to develop and refine analytical methods for detecting heavy metals,

pesticides and other environmental contaminants in freshwater fish and invertebrates and to the assay of bioaccumulation and biodegradation of toxic chemicals; contaminants of concern in the freshwater environment. Thus, the results are applicable to surveillance and monitoring of toxic chemicals in Great Lakes biota. Users include environmental and resource management agencies, and both public and private sector research organizations.

- Regional Limnology. This program supports comparative studies and surveys of freshwater ecosystems to provide an understanding of the influence of biological and chemical processes by factors such as climate, geology and human activity. Alteration of the ecosystem and determination of the impact on the lake ecology is relevant to the Great Lakes. The identification and quantification of critical ecological factors from this program, will permit the formulation of policies to protect and manage freshwater resources and will be useful to natural resource management agencies.

- Industrial Toxicology. This program conducts both fundamental and applied research to develop and apply bioassays for effluent toxicity testing studies, to understand the mechanisms of action of effluents and to influence the establishment of water quality objectives. The results of toxicity testing on freshwater fish and invertebrates is directly applicable to the Great Lakes and is of value in the development of industrial effluent standards and in formulating bioassay protocols to screen hazardous substances. Water quality objectives to benefit aquatic life will depend on these results.

b. Research Issues Addressed

Only ecological issues are studied by this agency, which identified the following issues and needs.
ECOL 2.2, 2.5, 3.2, 3.4, 3.5, 3.7, 3.8, 4.6, 7.1, 7.5, 8.2, 11.2, 11.3, 16.4, 18.2, 18.4, 20.3, 22.4, 24.1

c. Agency Comment

No comments were made on the adequacy of the "Research Needs Report."

N.B. The information requested was supplied in full by the agency representative.

d. Research Program Budgets

(a) Total Water Research Budget ($1,000); 6,705 & 245 MY (FY 76/77) in total agency budget, i.e. 3,336 & 131 MY for freshwater research and 3,369 & 114 MY for marine research

(b) Research Relevant to the Great Lakes Basin ($1,000); 2,400 and 90 MY (FY 76/77), i.e. 35.8% of the total water research budget or 71.94% of the freshwater budget

(c) Research Specific to the Great Lakes Basin ($1,1000); not included in this nation-wide program survey. See Ontario region of FMS, below

ii. Ontario Region - Great Lakes Biolimnology Laboratory, Burlington, Ontario

a. Program Narrative

- The Ontario Region Great Lakes Biolimnology Laboratory conducts research in four areas, two being IJC-related activities.

- Surveillance. The program is designed to collect and interpret data for the IJC Great Lakes Surveillance Sub-committee, with reference to both specific and general water quality objectives in regard to biota, productivity, species composition and contaminants present; due to human activities. Prediction of the effects of management strategies is also pursued. Users of these data include: senior resource management, the IJC Surveillance Sub-committee and the scientific community. Seven projects are supported by the program, including studies on the assessment of biological surveillance design, phyto species composition, benthos and sediments.

- Environmental Toxicology. This program supports studies on the effects of toxicants, both single and combined, and on the effects of environmental variation on toxicity and on the response of poisoned organisms to the environment so as to provide a better understanding of the environmental impact; as stated in the Environmental Contaminants Act. The results, of value to the IJC, will aid managers in assessing potential hazards of old and new compounds and in establishing criteria and objectives for water quality based on the response of aquatic biota. The seven projects covered include studies on: the effects of toxic materials on biota; the effects of low levels of toxicants on model ecosystems; biological methylation of metals in the aquatic environment; heavy metal interactions with microbial decomposition of algal detritus; fish response to environmental stress following sublethal intoxication; and biomagnification and effects of selected toxicants under simulated and other environmental conditions.

- Ecosystem Studies. Great Lakes ecosystems, particularly fish populations and their behaviour under environmental

stress, are studied under this program. The information obtained will be of value to the IJC in setting water quality objectives and to fish stock managers. Eight projects within the program include: persistent contaminants and fish stocks; acoustics for estimating fish abundance and biomass, the analysis of community structure; the effects of thermal electric, including nuclear, generating station discharges on fish and aquatic biota; and the results of nutrient removal on fish productivity.

- IJC Pollution from Land Use Reference Group Studies (PLUARG), Task Group "D". The IJC PLUARG Study Plan requires that Task Group "D" contribute to the understanding of land use practice on the Great Lakes international boundary waters. The program is intended to: characterize and quantify sediment input from shoreline erosion and rivers to the boundary waters of the Great Lakes and to establish the significance of these contributary processes; and to assess the impact of materials transported on the quality of these waters.

b. Research Issues Addressed

The programs address only ecological issues and needs and have been allocated by the agency.
ECOL 1, 1.1, 1.3, 3, 3.2, 3.3, 3.4, 3.5, 3.7, 3.8, 4, 4.2, 4.4, 4.5, 6, 6.1, 6.2, 7, 7.1, 7.2, 7.3, 8, 8.1, 10, 10.1, 10.2, 16, 16.4, 18, 18.1, 18.3, 18.4, 20, 20.1, 21, 21.1, 21.4, 21.5, 24, 24.1, 24.5, 24.6, 25, 25.1, 25.2

c. Agency Comment

No comments on the adequacy of the "Research Needs Report" were made.

d. Research Program Budgets

(a) Total Water Research Budget ($1,000); 6,705 & 245 MY (FY 76/77) in total agency budget, i.e. 3,336 & 131 MY for freshwater research and 3,369 & 114 MY for marine research
(b) Research Relevant to the Great Lakes Basin ($1,000); all specific to Basin, see below
(c) Research Specific to the Great Lakes Basin ($1,000); 405.8 & 32.5 MY (FY 76/77), i.e. 6.05% of the total water research budget or 12.16% of the freshwater budget

4. HEALTH AND WELFARE CANADA (NHW)

a. Program Narrative

The Health Protection Branch of this Agency has the following three Bureaus of two Directorates engaged in research relevant to Great Lakes Water Quality:

- Bureau of Chemical Safety, Foods Directorate;
- Bureau of Chemical Hazards, Environmental Health Directorate; and
- Radiation Protection Bureau, Environmental Health Directorate.

The Bureau of Chemical Safety supports four programs in the context of water quality. Toxicity of methyl mercury will be determined, using monkeys and cats, regarding the significance of subtle changes in the Central Nervous System and the establishment of an "acceptable daily intake" of this substance in man. These data, available in FY 77/78, will be used by the Federal and Provincial Health and Environmental Agencies to assess potential toxicity to humans of methyl mercury. A second program, on asbestos fibres in beverages and water, will study the toxicity of asbestos administered to rats and will include analyses for asbestos in food and food additives. The results, due by FY 78/79, will be used by the Federal and Provincial Health Agencies. The third program, toxic factors in foods, involves toxicological testing for various chemicals in foods. Hexachlorobenzene, a persistent organohalogen pesticide, will be assessed and the information (available in FY 78/79) will be used by the Federal and Provincial Health and Environmental Agencies. The fourth program, screening methods for determining pesticide residues in samples of plant and animal origin, has a portion devoted to the development and evaluation of automated procedures for pesticide residue analysis in support of pesticide monitoring programs. The results will be made available in FY 77/78 to those Federal and Provincial Health and Environmental Agencies interested.

The Bureau of Chemical Hazards supports two programs appropriate to this review. The program on environmental contaminants evaluation will assess the toxic potential of selected environmental contaminants and will develop criteria for the latter, to recommend standards for air and water environments. Projects supported will include studies on specific pulp mill effluent chemicals; the development of methodology for assessing toxicity; toxicity studies of photomirex and the investigation of the mutagenic properties of chemicals in the environment. Data will be made available in FY 77/78 to Federal and Provincial Health and Environmental Agencies and other groups. Drinking water is the second program supported, embodying the Environmental Health Directorate's responsibility for health aspects of drinking water. It is directed towards providing a safe supply of Canadian drinking water, both by setting standards and by performing research on drinking water. Projects will include methodology development for the quantitative estimation of organic contaminants in water, their identification and the establishment of a data base

for water quality information. The results will be made available in FY 77/78 for use by the Federal and Provincial Health and Environmental Agencies.

Only one appropriate program is supported by the Radiation Protection Bureau of the Environmental Health Directorate, that on nuclear installations monitoring and environmental radioactivity. Studies will be made of the occurrence of natural and man-made radioactivity in the environment and the results used to assess potential health effects on the Canadian population as well as developing criteria for recommending regulating control measures for radioactivity. Projects will include research on nuclear reactor environments, drinking water supplies and improvements in analytical methodology. Major user groups of these data, due in FY 77/78, will be Federal and Provincial Health and Environmental Agencies and the Atomic Energy Control Board of Canada.

b. Research Issues Addressed

Only ecological issues were addressed by this Agency.
ECOL 2.1, 2.3, 2.5, 3.1, 3.2, 3.8, 4.3, 8, 9.1, 9.3, 11.1, 20.3, 20.4, 22.1

c. Agency Comments

No agency comments were received regarding the Board's "Research Needs Report" but attempts were made to correlate issues and needs with Agency programs.

Six additional areas of related research are also underway within the Health Protection Branch and were brought to the attention of the Research Programs Committee - viz. organophosphorus pesticides, their toxic and neurotoxic properties; the toxicity of inorganic lead to monkeys; the toxicity of arsenic-contaminated fish; the teratological potential of pesticides; the toxicity of cadmium and methodology development for the quantitative estimation of herbicide residues.

N.B. All the above-noted research programs are conducted in non-Great Lakes regional facilities.

d. Research Program Budgets

(a) Total Water Research Budget ($1,000); not available
(b) Research Relevant to the Great Lakes Basin ($1,000); 1,655.1 (FY 76/77) and 67.1 MY
(c) Research Specific to the Great Lakes Basin ($1,000); not noted

5. ONTARIO MINISTRY OF AGRICULTURE AND FOOD (OMAF)

a. Program Narrative

The agency (OMAF) has identified a large variety of programs and numerous projects, in its response to the Committee. This selection involves primarily the activities of the Provincial Pesticide Residue Testing Laboratory, OMAF, Guelph, and other OMAF laboratories; the Canada Centre for Inland Waters (CCIW), Burlington; and several Faculties and Departments of the University of Guelph. In all, 23 programs plus 7 IJC (PLUARG) sub-programs are noted, together with 95 projects.

- Epidemiology, supporting 6 projects, covers the effects of toxic substances and diseases in fish, birds and wildlife, whereas the complementary programs on Toxicology and Pharmacology and Wildlife and Fish Management study organochlorides and other toxic chemicals in mammals and fish; with a total of 5 projects. The Human Residues program, with one project on Ontario residents, covers the human tissues aspect.

- Great Lakes Basin Studies involve 7 IJC PLUARG sub-programs having 12 projects concerned with watersheds emptying into the Great Lakes. These range from water quality monitoring of streams for PCBs to agricultural pollution of groundwater and surface water and sedimentology. Allied, is the Agricultural Surveys program (5 projects), monitoring for heavy metals, pesticides and other pollutants in domestic animal foodstuffs and dairy products.

- Waste Management. This program, with 7 projects, is concerned largely with agricultural animal and plant waste processing and disposal on arable land.

- Air Pollution. The program has two projects where crop sensitivity is used as an indicator of air pollution, especially ozone. Similar programs are: Plant Disease Control (2 projects); Vegetable Crops (2 projects); Fruit Crops (1 project on mulching); Ornamental Crops (3 projects); Grain Crops (3 projects); Forage Crops (4 projects); and Crop Production (1 project) programs are related.

- The Crop Mechanization (2 projects) and Crop Production (1 project) programs are related.

- The Weed Control (5 projects) and Insect Control (6 projects) programs are complementary, studying both pesticide and biological control strategies and entomology.

- Agricultural Meteorology (3 projects) is a program supporting several others, already noted, in its objectives.

- Agricultural Land Use, a large program with 20 projects, is primarily concerned with the economics of farming and rural land use in general.

- The Agriculture and Water Quality (6 projects) program studies the transport of water, soil and nutrients in agricultural watersheds.

b. Research Issues Addressed

This agency has investigated issues in all three research categories. In addition, several new issues have been defined, as follows, for the consideration of the Committee, viz:

- ECOL 28, Pest Management in Agriculture;
- ECOL 29, Water Management, Water Quality and Agriculture;
- ECOL 30, Agricultural Land Inventory;
- TECH 13, Animal and Plant Waste Handling and Utilization on Land;
- TECH 14, Improving Mechanical Application of Pesticides, Manures and Fertilizers for Food Production;
- TECH 15, Soil Compaction, Tillage Practices and Soil Erosion;
- TECH 16, Using Fertilizer to Maximize Food Production and Minimize Loss from Land; and
- SEP 19, Social-Economic-Environmental-Food Production

The OMAF's research programs cover the following issues, including the new.
ECOL 3, 4, 19, 24, (27, 28, 29, 30); TECH 3, (13, 14, 15, 16); SEP (19)

c. Agency Comment

It was noted that, in reference to the Board's report, many of the research needs are too general, seriously overlap with others, not clear and ill-defined or do not take into account current studies. It was admitted, however, that the outcome of this IJC study may well affect the entire OMAF and hence will require policy decisions in the Environmental Policy area. Thus, a closer ministerial involvement is anticipated.

d. Research Programs Budgets

(a) Total Water Research Budget ($1,000); not available
(b) Research Relevant to the Great Lakes Basin ($1,000); not available
(c) Research Specific to the Great Lakes Basin ($1,000); not available

6. ONTARIO MINISTRY OF THE ENVIRONMENT (OMOE)

a. Program Narrative

The Ontario Ministry of the Environment has two branches engaged in

water-related research relevant to the Great Lakes Basin, viz. the Pollution Control Branch and the Water Resources Branch.

The Pollution Control Branch supports the Wastewater Research Program of studies on the collection, treatment and disposal of wastewater and sewage sludge, covered by 21 projects. Also supported by this branch is the Drinking Water Research Program on the treatment and distribution of potable water and comprising 9 projects. Results from both programs will be made available to regulatory enforcement agencies, municipalities and consulting firms in the Great Lakes Basin.

One program, on water resources research, comprises the Water Resources Branch's contribution. The development is supported by specialized techniques to restore, enhance and assess water quality and to determine the effects of the latter on the natural environment. Eighteen projects are supported by this program.

b. Research Issues Addressed

This agency has investigated only ecological and technological issues.
ECOL 1, 1.2, 3, 3.3, 3.4, 3.5, 7, 7.2, 7.3, 9.2, 9.4, 9.5; TECH 1, 1.2, 1.4, 1.6, 2.2, 3.1, 4, 4.3, 7.1, 7.2, 7.3, 9

N.B. These issues and needs were allocated to this Great Lakes regional research facility's programs by the Subcommittee.

c. Agency Comments

No agency comments were received regarding the Board's "Research Needs Report," nor were any research issues or needs in the report identified with agency programs or projects. All programs provided were conducted in facilities within the Great Lakes Basin.

d. Research Program Budgets

(a) Total Water Research Budget ($1,000); 1,859 (FY 75)
(b) Research Relevant to the Great Lakes Basin ($1,000); 1,271.9 (FY 75, 76) and 65.59 MY
(c) Research Specific to the Great Lakes Basin ($1,000); not determined

N.B. Approximately 68.4% of the total aquatic research budget was used for Great Lakes-related studies. Also, no funding projections are available beyond FY 76, most projects terminating between 1976 and 1979.

7. ONTARIO MINISTRY OF HEALTH

a. Program Narrative

No details of research programs were provided in the agency response.

b. Research Issues Addressed

Referring to the Board's "Research Needs Report", the agency suggested that the following ecological research needs be given consideration. ECOL 2.1, 2.2, 2.3, 2.4, 3.1, 6.3, 9.2, 9.3, 12.1, 12.2, 12.3, 12.4, 12.5, 13.1, 14.1, 15.1, 17.3, 17.4, 17.5, 19.1, 19.3, 19.4, 26.2.

c. Agency Comments

Although endorsing the significance of the above-noted research needs, the agency notes that the Board recommends that research costs should be developed as a part of a technical and financial planning process by research management staffs of responsible agencies. No comment on the adequacy of the Board's report was made, however.

d. Research Program Budgets

(a) Total Water Research Budget ($1,000); not available
(b) Research Relevant to the Great Lakes Basin ($1,000); not available
(c) Research Specific to the Great Lakes Basin ($1,000); not available

8. ONTARIO MINISTRY OF NATURAL RESOURCES (OMNR)

a. Program Narrative

No agency programs are directed specifically towards water quality in the Great Lakes.

b. Research Issues Addressed

Not available.

c. Agency Comments

This agency noted that the "Research Needs Report" provided a comprehensive outline of the scope of appropriate research activities yet queried the priorties listed. It was felt that much can be accomplished utilizing existing knowledge although the decisions necessary to undertake any of the proposed research would be dependent upon budgetary stipulations.

d. Research Program Budgets

Not available.

9. ONTARIO HYDRO

a. Program Narrative

No details of research programs were provided in the agency response.

b. Research Issues Addressed

In reference to the Board's "Research Needs Report," interest was expressed in the following issues but no indication was given as to their status within Ontario Hydro.
ECOL 1, 4, 8, 10, 16, 18, 24; TECH 1; SEP 4, 5, 6, 7, 8, 9, 14, 15

c. Agency Comments

No comments on the Board's report were made, nor was the degree of relevance of current or proposed agency studies to these issues noted.

d. Research Program Budgets

(a) Total Water Research Budget ($1,000); not available
(b) Research Relevant to the Great Lakes Basin ($1,000); not available
(c) Research Specific to the Great Lakes Basin ($1,000); not available

PROGRAM NARRATIVES - UNITED STATES

UNITED STATES FEDERAL GOVERNMENT

1. DEPARTMENT OF AGRICULTURE
   - A. Agricultural Research Service

2. DEPARTMENT OF THE ARMY
   - A. Corps of Engineers

3. DEPARTMENT OF COMMERCE
   - A. National Oceanic and Atmospheric Administration
     - i. Great Lakes Environmental Research Laboratory
     - ii. Office of Coastal Zone Management
     - iii. Office of Sea Grant

4. DEPARTMENT OF INTERIOR
   - A. Geological Survey
   - B. Fish and Wildlife Service,
     Great Lakes Fishery Laboratory
   - C. Office of Water Research and Technology

5. DEPARTMENT OF THE NAVY

6. DEPARTMENT OF TRANSPORTATION
   - A. Coast Guard

7. ENVIRONMENTAL PROTECTION AGENCY

8. ENERGY RESEARCH AND DEVELOPMENT AGENCY

9. NATIONAL SCIENCE FOUNDATION

1. DEPARTMENT OF AGRICULTURE (DAG)

A. Agricultural Research Service (ARS)

a. Program Narrative

The research programs of concern conducted by the ARS deal mainly with agricultural practices and their effects on water quality. Though investigations aimed at preventing erosion in order to minimize soil loss from fields may be a prime goal, the same means will prevent eroded particles and their associated materials from entering waterways. Thus, two different objectives are reached simultaneously. ARS noted in their response that it was not practical to identify those portions of their broad-scope programs to the specific research needs. Thus, the monetary information they provide includes water quality related studies along with other aspects of their research.

Though much of the work is relevant to Great Lakes Basin situations, none is known to be located in the basin.

The total ARS budget for FY 1976 was $24,000,000.00, and has been assumed to be the same for FY 1977.

Programs include: Control of water erosion; wind erosion and sedimentation; preventing pollution of and improving the quality of soil; water; and air. This includes the management of wastes and the use of agricultural chemicals. Conserve and manage agricultural water resources.

b. Research Issues Addressed

ECOL 3.6, 3.8, 7.1, 7.2, 17.2, 20.5; TECH 3.1, 3.2, 6.1, 12.2

c. Agency Comments

No comments were made on the adequacy of the "Research Needs Report." However, an attempt was made to match water program elements to specific research issues. A listing of specific projects for the National Research programs relating to erosion control and pollution prevention was provided.

d. Research Program Budgets

(a) Total Water Research Budget ($1,000); assumed to be a maximum of $13,924
(b) Research Relevant to the Great Lakes Basin ($1,000); 9,454
(c) Research Specific to the Great Lakes Basin ($1,000); none

2. DEPARTMENT OF THE ARMY (DA)

A. Corps of Engineers (COE)

a. Program Narrative

The Corps of Engineers' research program of interest deals primarily with their dredging activities. Several sites around the country are used to explore the various phenomena associated with dredging. Very little of the research is being conducted in the Great Lakes Basin, though parts of the physico-chemical projects may be transferable to the basin. The biological research is nearly all marine or salt marsh oriented, hence is of little use in the basin.

The RAB program survey yielded only information from the Vicksburg Waterways Experiment Station and should be assumed to be less than the total Corps of Engineers or U.S. Army research effort.

The budget information includes several years of effort based on the listed completion dates, these ranging from October, 1973, to January, 1978.

The main thrusts of the program include prediction of dredged material behavior, use and development of spoil areas, reduction of contaminants from spoils, ecological effects of dredging, and spoil confinement techniques.

b. Research Issues Addressed

Extracted from a listing of projects, U.S. Waterways Experiment Station.
TECH 5.1 ($2,230,642. per 5 years); 5.2 ($2,907,790. per 5 years); 5.3 ($5,784,647. per 5 years); 5.4 ($1,319,997. per 5 years)

c. Agency Comments

None.

d. Research Program Budgets

(a) Total Water Research Budget (1,000); 19,267. in dredging
(b) Research Relevant to the Great Lakes Basin ($1,000); 12,243
(c) Research Specific to the Great Lakes Basin ($1,000); essentially none

3. DEPARTMENT OF COMMERCE (DOC)

A. National Oceanic and Atmospheric Administration (NOAA)

i. Great Lakes Environmental Research Laboratory (GLERL)

a. Program Narrative

This laboratory's diverse program is aimed at, and conducted on, the Great Lakes specifically. In essence, the program is concerned with processes, properties, and phenomena of the Great Lakes and their watersheds.

Program areas of involvement include: Water movements and temperatures; surface waves and water level fluctuations; the Lake Ontario energy budget (IFYGL); aquatic ecology models and related studies; planktonic succession; dynamics of material movements in the nearshore zone; hydrologic properties; lake ice; environmental information services; environmental engineering models and applications.

b. Research Issues Addressed

ECOL 7.2, 7.3, 7.4, 10.1, 24-part; SEP 6.2

c. Agency Comments

No commentary made as to the adequacy of the "Research Needs Report."

d. Research Program Budgets

(a) Total Water Research Budget ($1,000); apparently $2,725
(b) Research Relevant to the Great Lakes Basin ($1,000); same
(c) Research Specific to the Great Lakes Basin ($1,000); same

ii. Office of Coastal Zone Management (OCZM)

a. Program Narrative

The response from OCZM noted that they do not fund water quality studies, but pointed out some projects that may be pertinent to the "Research Needs" document. Among these were "Energy Facility Siting in the Great Lakes Coastal Zone: Analysis and Policy Options" and a Great Lakes Regional Coastal Information Center Feasibility Project that would serve as a repository for State-generated data.

b. Research Issues Addressed

SEP 3.4, 4.1, 6.2, 6.4

c. Agency Comments

Agency not directly involved in water quality research.

d. Research Program Budgets

No budgetary information was provided by OCZM.

iii. Office of Sea Grant

a. Program Narrative

The Office of Sea Grant provides funds to universities for aquatic research. These funds are supplemented by those from non-federal sources, the ratio being roughly 50:50. Within the Great Lakes Basin, universities in Wisconsin, Michigan and New York are involved.

In this discussion, total budgets are noted and are not separated as to federal and non-federal components.

The Sea Grant program deals with a wide variety of subjects, including: natural history and dynamics of the biota and ecosystem; dynamics and effects of contaminants and micro-contaminants; recreational and social aspects related to water use; ocean engineering; and resource utilization and measurement

b. Research Issues Addressed

ECOL 1.2, 3.2 thru 3.8, 4.2, 4.4, 7, 11.4, 11.6, 16.4, 20, 21.3, 24.2; TECH 8.1, 8.2; SEP 8.3, 14.1, 14.2, 18

c. Agency Comments

A listing of specific projects and project budgets was provided. Moreover, in a report developed for internal use by J. Philip Keillor ("Some Research Needs for the Great Lakes Appropriate to the Micro-contaminants and Water Quality Subprogram of the Wisconsin Sea Grant Program") research needs highlighted by the "Research Needs Report" appropriate to the cited area were proposed as critical.

d. Research Program Budgets

(a) Total Water Research Budget ($1,000); 2,810
(b) Research Relevant to the Great Lakes Basin ($1,000); 912.6
(c) Research Specific to the Great Lakes Basin; ($1,000); 912.6

4. DEPARTMENT OF THE INTERIOR (DOI)

A. U.S. Geological Survey (USGS)

a. Program Narrative

The U.S. Geological Survey, in cooperation with State and local government agencies, maintains an extensive data network to monitor the quantity and quality of water that enters the Great Lakes. The USGS data network within the basin consists of about 900 stations to monitor surface waters carried by streams. Of these, some 118 stations are located at the mouths of streams. Research interests center on problems of water availability, water use management, sediment transport, erosion, pollution and flooding.

Specific research activities conducted external to the basin but having relevance to Great Lakes needs include studies relating to: the availability of trace elements in sediments to macroinvertebrates; the development and evaluation of methods for determination of organic compounds in water and sediment; the verification of models simulating water quality changes in surface waters; and the definition of transport mechanics in surface water.

Programs specific to the Basin include a major thrust in characterizing nonpoint source inputs from a variety of land use activities with particular emphasis on erosion products. Watershed studies involved include: the Menominee River Basin (Wisconsin); the upper reaches of the St. Joseph River (Michigan); the Nemadji River Basin (Minnesota); and the Genesee River Basin (New York).

b. Research Issues Addressed

ECOL 3.3, 3.7, 7.3, 20.4; TECH 3.1

c. Agency Comment

No comments made with respect to the adequacy of the "Research Needs Report." Some attempt made to match agency research effort to "Research Needs Report."

d. Research Program Budgets

(a) Total Water Research Budget ($1,000); 19,690 (FY 76); 20,675 (FY 77)
(b) Research Relevant to the Great Lakes Basin ($1,000); 765 (FY 76); 927 (FY 77)
(c) Research Specific to the Great Lakes Basin ($1,000); 489 (FY 76); 421 (FY 77)

B. Fish and Wildlife Service (FWS)

i. Great Lakes Fishery Laboratory

a. Program Narrative

To facilitate the development and dissemination of its research findings and services, the Laboratory's program is organized along three major lines: Resource Assessment; Ecology and Limnology; and Physiology and Contaminant Chemistry. This array of multidisciplinary expertise sustains not only the Laboratory's traditional work on measuring the projection of the impact of fishing on Great Lakes fishery resources, but also performs an increasingly wide variety of research to determine the additional effects thereon of yet other stresses, such as those caused by habitat alteration and contamination. Besides the large volume of assessment-related survey work and data analysis performed afield and in the laboratory, activity in various experimental facilities administered by the Laboratory is yielding valuable information on how fishes (and fish populations) are affected directly and indirectly by PCBs, other chlorinated hydrocarbons, and heavy metals; by operation of (and waste heat from) power plants; by dredging and filling; and by the depredations of residual sea lampreys.

Facilities

Stations--Comprising the Great Lakes Fishery Laboratory are the:

- Ann Arbor Laboratory: On North Campus, University of Michigan, a modern building (44,000 sq. ft.) containing large, continuous-flow water systems for experimental biology, fully-equipped chemistry laboratories, computer, library, offices, etc., (66 employees);

- Ashland (Wis.) Biological Station: Base for research and survey operations on western Lake Superior (8 employees);

- Hammond Bay Biological Station (Millersburg, Mich.); On northern Lake Huron, site of ecological studies and of special GLFC-funded research on the sea lamprey (10 employees);

- Cheboygan (Mich.) Vessel Base: For survey operations on Lake Huron, northern Lake Michigan, and eastern Lake Superior;

- Saugatuck (Mich.) Vessel Base: For survey operations on southern Lake Michigan;

- Sandusky (Ohio) Biological Station: Houses research and survey operations on Lake Erie (6 employees); and

- Oswego (N.Y.) Biological Station: Base for research and survey operations on Lake Ontario (6 employees).

Vessels--Administered from Ann Arbor by the GLFL's Vessel Management Services unit are the:

- R/V Siscowet (57'): Lake Superior - Ashland/Bayfield (3 employees);

- R/V Cisco (60'): Lake Michigan - Saugatuck (3 employees);

- R/V Grayling (75'): Lake Huron, Superior, Michigan - Cheboygan (3 employees);

- R/V Musky II (45'): Lake Erie - Sandusky (2 employees);

- R/V Kaho (65'): Lake Ontario - Oswego (3 employees);

- R/V Hiodon (46'): Lake St. Clair - Mt. Clemens;

- Various small craft to 25', for work nearshore as well as in bays and rivers.

(Total anticipated cost of vessel O&M in FY 1979 is $393,000.)

Other--Major support functions housed at Ann Arbor are the:

- Biometrics and Computer Services Unit IBM 1130 and peripheral equipment, aligned with University of Michigan's IBM 360/67 MTS System;

- Library and Information Services Unit, John Van Oosten Memorial (Fisheries) Library.

Resource Assessment--Major fishery resource problems in the Great Lakes include: (1) lamprey-threatened fish stocks; (2) diminished yields from some populations of important endemic fishes such as the lake herring, lake whitefish, chub, walleye, and yellow perch; (3) inadequate information about the effects of fishing and other mortality agents on stocks of these and other species, especially the lake trout: (4) uncertainty about the size and potential of populations of forage species like the alewife and smelt, on which the continued success of rebuilt as well as introduced salmonid stocks is critically dependent; (5) physical alteration and reduced carrying capacity of nearshore spawning and nursery habitat; (6) underutilization of low-value fishes with market potential; and (7) the need for more effective, resource-wide, fishery management strategies. Laboratory projects in this section take account of the particular mix and priority of problems in each lake, as well as of the special interests and assessment capabilities of each state and provincial agency involved. Major contributions include participation in cooperative lakewide surveys of important sport, food, and forage fish populations; research on the biology and dynamics of major fish populations; continuing evaluation of sea lamprey control and lake trout restoration efforts; and technical assistance in the development of interagency management plans.

Ecology and Limnology--Overfishing of desirable species; water-use practices that cause deterioration and destruction of critical fish habitat, particularly in the nearshore waters; and the introduction of undesirable exotic fishes, including the sea lamprey, have collectively caused the decline or extinction of many desirable native fishes and an increase in the abundance of other less desirable species. To the extent that it cannot be halted or controlled, abuse of their environment will continue to impede the restoration and otherwise impair the productivity of Great Lakes fishery resources.

Multiple-use of the Great Lakes--for navigation, as a municipal and industrial water supply, and for the final dispersion of the basin's water-borne wastes--poses a poorly quantified but increasingly serious threat to the habitat and productivity of Great Lakes fishery resources. Maintenance of waterways, for example, is expected to entail the annual dredging and redeposition of as much as 12 million cubic yards of lake bottom materials by 1983, with relatively unknown effect on the health of valuable fish stocks. Water use by the electric-power generating industry by the turn of the century may exceed 1-2% per day of the total volume of the nearshore waters of the Great Lakes, with destruction of fish in these waters varying widely but approaching 100% in some situations. Research

projects in this section of the Laboratory's program describe the effects of these and other water-use practices on fish and their habitat, so that less destructive methods of water withdrawal and alteration can be developed.

Although the sea lamprey, a serious predator on Great Lakes fish, has been reduced to 10-20% of its former peak abundance by the use of selective toxicants (larvicides), further reduction by this means would be prohibitively expensive. Moreover, growing controversy over the use of chemicals in streams, for whatever purpose, fuels additional concern by fishery managers. Studies administered by this section are aimed at developing alternative cost-effective methods for sea lamprey control, as well as providing a more accurate assessment of the effect of residual lamprey populations on Great Lakes fish stocks.

Specific projects within the program include: effects on fish resources and habitat of water-use/development practices; nutrient cycling and plankton productivity; benthos as indicators of environmental quality; alternative methods of sea lamprey control; effect of proposed ice-management strategies on benthos.

Physiology and Contaminant Chemisty--Changes in the physical and chemical characteristics of the Great Lakes--changes occurring naturally as well as those induced by man's use of the lakes as a water resource--all affect in subtle and often adverse ways the productivity of their fishery resources. The problem then is how best to measure as well as predict the effects of these changes so that causes can be effectively eliminated, mitigated, or otherwise taken into account. Prerequisites for making these predictions in the case of Great Lakes fishes are determinations of their normal physiological and behavioral characteristics, and our interpretation of how environmental changes alter them. The aim of research performed in this section is to provide, by means of carefully controlled experiments, this kind of basic information. Foremost among current concerns is the serious threat posed by chemical contaminants to the aquatic environment, to fish, and to fisheries of the Great Lakes. Toxic substances such as DDT and its metabolites, dieldrin, polychlorinated biphenyls (PCBs), mercury, and several other pesticides, industrial organics, and metals are present in fish of the Great Lakes. Some of these materials exceed USFDA guidelines for human consumption, and all are of concern due to their potential effects on fish populations. Informed recommendations for the protection and management of Great Lakes fisheries require knowledge of the types and amount of chemical contamination in the various species, the dynamics and possible effects of known contaminants (both singularly and in combination),

and the effectiveness of past enforcement actions in reducing contamination. Development of such knowledge is the objective of two projects administered by this section.

b. Research Issues Addressed

ECOL 5, 16, 18, 21

c. Agency Comment

No comments were made on the adequacy of the "Research Needs Report."

d. Research Program Budgets

(a) Total water research budget ($1,000); $2,590
(b) Research Relevant to the Great Lakes Basin ($1,000); $2,590
(c) Research specific to the Great Lakes Basin ($1,000); $2,017

C. Office of Water Research and Technology (OWRT)

a. Program Narrative

The Office of Water Research and Technology, U.S. Department of the Interior, sponsors a broad program of extramural research encompassing a wide array of water resources problems including: water supply augmentation and conservation; water quantity management and control; water quality management and protection; and water resources planning. The program is implemented through allocations to water resources institutes established and operated by each State under the provisions of the institute-sponsored research projects, and direct grants to individuals and organizations; both public and private.

OWRT also manages the Water Resources Science Information Center, which serves as a focal point in the Federal government for co-ordination and dissemination of technical information and for planning and accomplishment of many activities relating to the Federal Great Lakes program.

Of the monies expended for the national research program, approx-imately 55% is assigned to water quality management and water resources planning areas; respectively. Forty percent of this commitment is pertinent to Great Lakes water quality needs.

Ecological issues, which account for approximately 40% of this commitment, concern program objectives directed to the develop-ment of improved methods for the identification and quantification of water borne contaminants and to induced environmental effects

on aquatic communities and the lake ecosystem. Specific emphasis is given to improved analytical procedures for trace organics and to the development of a variety of environmental indicators including the use of tissue bioassays, indicator algae and bioluminescence exhibition. Applications of remote sensing technology and cost effective systems for obtaining water quality data are also considered. Limited efforts are evident in areas related to the source and fate of contaminants with the focus of this activity centered on characterizing reactions and mechanisms pertinent to the sediment water interface.

A wide variety of projects related to environmental effects and ecosystem response are sponsored including: definitions of nutrient requirements and mechanics of nutrient cycling; algae sinking rates; effects of zooplankton grazing; fate of viruses and pathogenic bacteria; control of algae and aquatic macrophytes by chemical and biological means; and factors which affect shoreline erosion and machrophyte growth in littoral areas.

Programs addressing technological issues account for 42% of the effort, with major emphasis on the control of a variety of pollutants. Specific emphasis is given to the following areas: characterization of nonpoint source pollution including inputs from urban, forested and agricultural areas and the development of methodologies for its control; development of cost effective technology for sludge handling and disposal with a particular focus on land disposal; all aspects of land disposal of liquid effluents including the development of design criteria, the assessment of potential environmental effects and the economics of the process as a viable treatment alternative. Additional efforts are directed to point source nutrient control, primarily nitrogen; disinfection; and the removal of heavy metals.

A significant effort is directed to the improved design, operation and assessment of a number of treatment unit operations. Included in the array are: the activated sludge process; activated carbon; mound systems for on lot disposal; and an evaluation of the effectiveness of current treatment technology for the removal of pathogenic bacteria, viruses and heavy metals.

Emphasis in the socio-economic areas is given to the development of methodologies and establishment of guidelines for: the multi-objective planning of water resources; the definition of social and economic impacts of water quality improvement; community involvement in the decision making process and the establishment of effective information transfer systems. Studies involving the evaluation of institutional arrangements necessary to the establishment of regional systems and on water based recreation are also sponsored.

b. Research Issues Addressed

Most issues addressed to some degree.
ECOL 1, 10, 11.1, 11.2, 10, 18; TECH 2, 9; SEP 2, 18

c. Agency Comment

No comments made with respect to the adequacy of the "Research Needs Report." Agency attempt was made to match agency research effort to the "Research Needs Report."

d. Research Program Budgets

(a) Total Water Research Budget ($1,000); 20,526 (FY 76); 14,996 (FY 77)
(b) Research Relevant to Great Lakes Basin ($1,000); 5,338 (FY 76); 4,821 (FY 77)
(c) Research Specific to Great Lakes Basin ($1,000); not determined

5. DEPARTMENT OF THE NAVY (DON)

Naval Material Command-Washington, D.C.; and
Naval Ship Research and Development Center-Annapolis, Md.

a. Program Narrative

The response of the U.S. Navy deals with research specific to naval problems, these being: shipboard wastes; oil spill prevention and clean-up; and energy matters.

The oil pollution abatement and clean-up programs - $4,100,000 efforts - are aimed at the development of oil/water separator systems, spill monitoring instrumentation, and spill recovery equipment. The program dealing with shipboard waste treatment is for the development of an integrated system for all wastes generated on board. This is a $2,900,000 program; $9,500,000 is planned for the development and conservation of energy resources that are used for naval operations.

b. Research Issues Addressed

TECH 4.1, 4.3, 8.5: SEP 9

c. Agency Comments

The U.S. Navy does not have an ongoing research program pertaining to Great Lakes Water Quality.

d. Research Program Budgets

(a) Total Water Research Budget ($1,000); 16,500
(b) Research Relevant to the Great Lakes Basin ($1,000); 7,000
(c) Research Specific to the Great Lakes Basin ($1,000); none

6. DEPARTMENT OF TRANSPORTATION (DOT)

Coast Guard (USCG)

a. Program Narrative

The Coast Guard originates no basic water quality research. However, it provides hardware to assist EPA and NOAA when requested, i.e. ship operating platforms.

b. Research Issues Addressed

None.

c. Agency Comments

Mention is made of a summary of multiagency R & D effort having fringe impact on water quality in the Great Lakes. Details are given in Appendix h.

d. Research Program Budgets

Not applicable.

7. ENVIRONMENTAL PROTECTION AGENCY (EPA)

Office of Research and Development

a. Program Narrative

The U.S. EPA is primarily an enforcement agency which maintains a research program to provide the scientific and technical base for reasonable standards and regulations. In their pollution abatement efforts, water is an important medium. In general, the research centers around ecological processes and effects of pollutants; fate, transformation, and transport of pollutants; removal or prevention of pollutants; health effects of pollutants; and water supply.

The majority of the above-mentioned research is suitable for large regional, if not national problems and has been deemed transferable to the basin. Only a small portion of the total effort is directed specifically to the Great Lakes.

The Great Lakes specific program is conducted by the Large Lakes Research Station at Grosse Ile, Michigan. This station is under the management of the Environmental Research Laboratory-Duluth, i.e. ERL-Duluth. The main thrusts of this program include the following program areas: application and development of eutrophication planning models; delineation of the variables associated with eutrophication; dispersion and fate of hazardous materials; nutrient and chemical fluxes in sediments; larval fish and power plants; mathematical

models of water quality in large lakes; atmospheric input of pollutants; factors affecting *Cladophora* growth; and hydrodynamic movement of pollutants.

Marine, estuarine, and other media research has essentially been omitted from this discussion, as has all "pass-through" funds. Appropriate "energy" research is included.

The needs document format differs significantly from the EPA system of planning and reporting, hence caution is advised when comparing the budget breakdown to the needs. Difficulty was experienced in dividing the combined EPA programs to compare to the needs. The research needs addressed were not noted in the survey reply, but were determined by the committee. Some of the information was derived from sources other than the official response by the agency.

Specific components of the program are as follows:

I. ECOLOGICAL PROCESSES AND EFFECTS

A. Freshwater ecological processes and effects (ERL - Duluth; ERL - Corvallis)

The determination of toxic effects on organisms for early warning of chronic effects; the determination of the response of ecosystems to pollutants and the effects of ecosystems on pollutants; the development and testing of short term methods to determine the hazards to organisms and ecosystems from toxic and hazardous substances; the determination of toxic characteristics and effects of complex effluents in ecosystems; the characterization of pollution problems in the Great Lakes including an assessment of dynamic processes affecting pollutants and the development of management oriented models to describe these fates and effects (Large Lakes Research Station, Grosse Ile, Michigan).

B. Fate and effect of synthetic organic compounds on aquatic ecosystems (ERL - Duluth)

The determination of the effect of pesticides or pesticide combinations on organisms and ecosystem-level parameters; the determination of the fate and rates of reactions of pesticides in aquatic ecosystems.

C. Ecological effects of substitute pesticide chemicals (ERL - Duluth)

D. Effect of energy related pollutants on organisms and ecosystems (ERL - Duluth)

II. TRANSPORT AND FATE OF POLLUTANTS (ERL - Athens)

The evaluation and prediction of the transport, transformation and fate of trace organic and inorganic pollutants entering freshwater ecosystems; the prediction of water quality impacts resulting from

point and non-point sources; the evaluation of the cost effectiveness of alternative control strategies and the assessment of the transport and fate of energy related pollutants in aquatic ecosystems.

III. HEALTH ASPECTS (Health Effects Research Laboratory - Cincinnati)

A. Multi-route exposures and their effects: identification of the health effects of non-pesticide substances commonly reaching man by multiple routes of exposure

The development of screening systems for the rapid assessment of potential health damage from inorganic chemicals.

B. Water quality health effects: health effects associated with the treatment and disposal of wastewater and sludge

The assessment of the health implications of present and innovative technology with an emphasis on application to agricultural land.

C. Multi-route exposures and their effects: determination of the health implications of substances used as pesticides

The investigation of potential health effects of pesticides now registered and in common use; the evaluation of the human safety of "new generation" pest control agents; the development and evaluation of new toxicological methods; and the development and application of analytical methods for detection in environmental samples and human tissue.

D. Health effects research - energy related air, water and multi-route exposure

The evaluation of the effects of energy related agents on human health; and the assessment of health risks to human populations associated with all aspects of energy production and utilization.

E. Water supply

The determination of the nature and concentration of organic, inorganic, and microbial contaminants in water supplies; the determination of potential health effects associated with water reuse for domestic purposes; and an assessment of health effects of asbestos fibers in drinking water.

IV. WASTE MANAGEMENT AND WATER SUPPLIES
(Municipal Environmental Research Laboratory - Cincinnati)

A. Urban runoff pollution control

To quantify the impact of urban stormwater and to develop technology for its control.

B. Treatment technology program

To develop methods for the processing, treatment and disposal of municipal sludges, including land application management; to develop methods to improve efficiency, reliability, cost effectiveness and reduced energy sensitivity of municipal wastewater treatment; to develop and test new treatment alternatives including disinfection technology, nutrient and hazardous organics control as well as innovative biological systems; to develop technology for the production of potable water from municipal wastewater effluent and for the control of toxics; to develop control measures to eliminate pollution from small watersheds; and to investigate and develop methods for the application of wastewater to land and the use of aquaculture as a system for the polishing of domestic wastewater effluents (R.S. Kerr - ERL - Ada, Ok.).

V. METHODS DEVELOPMENT

A. Identification of constituents in water supply, aquatic ecosystems (ERL - Athens, Ga.)

To develop methodologies for the analysis of trace organics, and multi-elements in drinking water; to devise new and improved techniques for the identification and measurement of chemical constituents in aqueous systems and soils including volatile organics; non-volatile organics; and multi-elemental analytical techniques and speciation by elements.

B. Methodology for the concentration, recovery, and identification of viruses from ambient waters, wastewaters, and associated solids (ERL - Cincinnati)

Budget assignments for the programs described are as follows:

1.	Freshwater Ecological Process and Effects (in $1,000.):	
A.	Great Lakes research, per se	2,017.
B.	Toxicology and bioassay development	3,164.
C.	Synthetic organics	150.
D.	Substitute pesticides	68.
E.	Energy related materials	1,426.
	Total 1:	6,825.
2.	Transport, Transformation and Fates (in $1,000);	
A.	Processes	305.
B.	Assessment and simulation	832.
C.	Watershed management	933.
D.	Energy related materials	450.
	Total 2:	2,520.

3. Health Aspects (in $1,000):

A.	Non-pesticide substances	470.
B.	Municipal wastewater and sludge	1,280.
C.	Pesticides	3,690.
D.	Water supply	6,300.
E.	Energy related (part is air)	1,055.
	Total 3:	12,795.

4. Waste Management and Water Supply (in $1,000):

A.	Urban runoff control	1,043.
B.	Municipal wastewater treatment	8,631.
C.	Solid and hazardous wastes	3,856.
D.	Water supply treatment	4,997.
E.	Oil and hazardous material spills	2,000.
	Total 4:	20,527.

5. Methods Development (in $1,000):

A.	Water supply contaminants	800.
B.	Water and soil constituents	1,130.
C.	Viruses	521.
	Total 5:	2,451.

A more detailed breakdown of program budgeting by project activity is available.

b. Research Issues Addressed

(1) ECOL 3.3, 3.4, 3.5, 3.6, 3.7, 3.8, 4.1, 4.2, 4.3, 4.4, 4.5, 7, 10.1, 11.1, 11.3, 11.5, 18.1, 20.1, 20.2, 20.3, 20.5, 20.6, 21.6, 24
(2) ECOL 2.5, 3.7, 3.8, 4.2, 4.4, 6.2, 7, 11.5, 20.5, 20.6, 22.4
(3) ECOL 2.1, 2.2, 2.3, 6.3, 9.2, 9.3, 9.4, 12.1, 12.2, 12.3, 17.3, 17.5, 17.6, 19, 25; TECH 1.1, 1.2, 6, 7
(4) ECOL 17, 19.2, 23.2; TECH 1, 2, 3, 4, 6, 8, 10, 11, 12.1, 12.2
(5) ECOL 2.4, 3.2, 4.3, 9.1, 11.1, 20.4, 22.1

c. Agency Comment

No comments were made made as to the adequacy of the "Research Needs Report."

d. Research Program Budgets

(a) Total Water Research Budget ($1,000); not available
(b) Reseach Relevant to the Great Lakes Basin ($1,000); 45,118
(c) Research Specific to the Great Lakes Basin ($1,000); 2,017

8. ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION (ERDA)

Division of Biomedical and Environmental Research

a. Program Narrative

Programs supported by ERDA of relevance to the Great Lakes are summarized below.

- Characteristics, Transport and Conversion of Energy Pollutants in the Environment

  This program is designed to provide knowledge to define the physico-chemical properties of energy related materials and to describe the geochemical behavior of such potentially toxic materials in aquatic ecosystems so that a reliable prediction of their fates and transport in aquatic ecosystems such as the Great Lakes may be made if further inputs occur. Budget FY 1977..$875,000.

- Environmental Effects of Energy Related Processes and Pollutants on the Environment

  The objective is to assess the ecological effects of potentially toxic materials and mechanical systems related to energy production and conversion on phytoplankton, zooplankton, zoobenthos, and fish in aquatic ecosystems such as the Great Lakes. Budget FY 1977..$385,000

- Fundamental Environmental Processes Related to Energy

  The objective is to quantify the aerodynamic and hydrodynamic mechanisms which transport and disperse pollutants near the marine boundary layer and in Lake Michigan with regard to general circulation and to exchange between coastal waters and those of the open lake. Budget FY 1977..$333,000

- Nutrient Enrichment and Eutrophication of Lake Michigan

  The objective is to determine the roles of phosphorus and silica in relation to processes associated with eutrophication of Lake Michigan. Budget..$95,900.

- Plutonium and Americium Concentrations Along Freshwater Foodchains in the Great Lakes, U.S.A.

  The objective is to elucidate the pathways of distribution and of biological uptake of transuranic and fallout radionuclides in Lake Ontario and eastern Lake Erie. Budget FY 1977..$92,500.

b. Research Issues Addressed

ECOL 3, 3.6, 3.7, 3.8, 7, 8, 10.1, 24

c. Agency Comment

No comments made with respect to the adaquacy of the "Research Needs Report."

d. Research Program Budgets

(a) Total Water Research Budget ($1,000); $15,992
(b) Total Freshwater Research Budget ($1,000); $6,240
(c) Research Relevant to the Great Lakes Basin ($1,000); $1,781
(d) Research Specific to Great Lakes Basin ($1,000); $1,781

9. NATIONAL SCIENCE FOUNDATION (NSF)

Division of Advanced Environmental Research and Technology

a. Program Narrative

The response of NSF contained considerable information, but was rather difficult to summarize due to the fragmentary nature of the material. The cover letter notes that the NSF Division of Advanced Environmental Research and Technology intends to focus additional effort on urban water management research pertinent to the urban context and that FY 1977 actions and budget are generally not available.

The Urban Water Management Program is aimed at: (1) influence of land use; (2) integrated impacts of land, air, and water pollution; (3) erosion and sedimentation; and (4) costs and benefits of alternative schemes. The total FY 1977 budget for this program is $900,000.

A brief outline from the submission for FY 1976 is of interest: Division of Advanced Environmental Research and Technology - awards of $25,546,000.

(i)	Chemical Threats to Man and Environment:	$5,323,000
	- Environmental Assay Methodology (trace elements)	122,000
	- Metals and Organometallic Compounds	1,240,000
	- Organic Chemicals of Commerce	1,254,000
	- Environmental Effects of Energy	191,000
(ii)	Regional Environmental Management	$5,898,000
	- Institutional Aspects	205,000
	- Land Use	339,000
	- Residuals Management	1,192,000

b. Research Issues Addressed

ECOL 3.2, 3.6, 3.7, 3.8, 7, 10.4, 11.2, 11.3, 11.5, 14, 17; TECH 1.2, 12; SEP 3, 15

c. Agency Comments

The agency did not comment on the adequacy of the "Research Needs Report."

d. Research Program Budgets

(a) Total Water Research Budget ($1,000); (FY 76), approximately 900
(b) Research relevant to the Great Lakes Basin ($1,000); and
(c) Research Specific to the Great Lakes Basin ($1,000); essentially none

APPENDICES

A TERMS OF REFERENCE, RESEARCH PROGRAMS COMMITTEE

Introduction

The Research Programs Committee was established by vote of the Research Advisory Board at its Eighteenth Meeting, September 16, 1976, as an executive committee of the Board, to provide a focus for the assessment of on-going research programs pertaining to the quality of the waters of the Great Lakes System. The Terms of Reference of this Committee tie directly to the Terms of Reference of the Research Advisory Board, Section 2(a). The Research Programs Committee is established to provide a vehicle for the organization, analysis and documentation of Great Lakes water quality research efforts from all pertinent sources for the Research Advisory Board.

Functions

Within the functions and responsibility of the Research Advisory Board, the functions and responsibilities of the Research Programs Committee are as follows:

1. To solicit information from all appropriate sources on research programs pertaining to the quality of waters of the Great Lakes System.

2. To advise the Research Advisory Board of the adequacy and responsiveness of these research programs to research needs identified by the Research Advisory Board.

3. To advise the Research Advisory Board on additional research efforts that should be undertaken and emphasize specific programs for which international cooperation will be productive.

4. To prepare, at regular intervals, a research programs evaluation for presentation to the Research Advisory Board.

B MEMBERSHIP:

(a) RESEARCH PROGRAMS COMMITTEE

(b) RESEARCH NEEDS REPORT REVIEW SUBCOMMITTEE

- Research Programs Report Preparation

RESEARCH PROGRAMS COMMITTEE

Prof. A. J. McDonnell
Department of Civil Engineering
Water Resources Research Center
The Pennsylvania State University
University Park, Pennsylvania 16802

Mr. Paul D. Foley
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Development & Research Group
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Secretariat Responsibilities

Dr. A. E. P. Watson
Research Scientist
International Joint Commission
Great Lakes Regional Office
100 Ouellette Avenue, 8th Floor
Windsor, Ontario N9A 6T3

RESEARCH NEEDS REPORT REVIEW SUBCOMMITTEE

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Water Resources Research Center
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University Park, Pennsylvania 16802

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Secretariat Responsibilities

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Research Scientist
International Joint Commission
Great Lakes Regional Office
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Windsor, Ontario N9A 6T3

C TERMS OF REFERENCE, RESEARCH ADVISORY BOARD

1. As used herein, "research" includes development, demonstration and research activities, but does not include regular monitoring and surveillance of water quality.

2. The functions and responsibilities of the Research Advisory Board relating to research activities in Canada and the United States concerning the quality of the waters of the Great Lakes System shall be as follows:

(a) to review at regular intervals these research activities in order to:

(i) examine the adequacy and reliability of research results, their dissemination, and the effectiveness of their application;
(ii) identify deficiencies in their scope, and inadequacies in their funding and in completing schedules;
(iii) identify additional research projects that should be undertaken;
(iv) identify specific research programs for which international cooperation will be productive;

(b) to provide advice and consolidations of scientific opinion to the Commission and its boards on particular problems referred to the Advisory Board by the Commission or its boards;

(c) to facilitate both formal and informal international cooperation and coordination of research; and

(d) to make recommendations to the Commission.

3. The Research Advisory Board on its own authority may seek analyses, assessments and recommendations from other professional, academic, governmental or intergovernmental groups about the problems of the Great Lakes water quality research and related research activities.

4. The International Joint Commission shall determine the size and composition of the Research Advisory Board. The Commission should appoint members to the Advisory Board from appropriate Federal, State and Provincial Government agencies and from other agencies, organizations and institutions involved in Great Lakes research activities. In making these appointments the Commission should consider individuals from the academic, scientific and industrial communities and the general public. Membership should be based primarily upon an individual's qualifications and potential contribution to the work of the Advisory Board.

5. The Research Advisory Board should work at all times in close cooperation with the Great Lakes Water Quality Board.

D MEMBERSHIP LIST 1976-78, RESEARCH ADVISORY BOARD

CANADIAN SECTION

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Special Advisor
IJC Obligations and Research
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Dr. J. R. Vallentyne
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Dr. Eugene J. Aubert
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Mr. Alvin R. Balden
(Until Oct. 1976)
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U.S. Environmental Protection Agency
26 West St. Clair Street
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(Until Oct. 1976)
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Mrs. Evelyn Stebbins *(Until Dec. 1976)*
Citizens for Clean Air & Water Inc.
Rocky River, Ohio 44116

Dr. Mitchell Zavon
Medical Director
Hooker Chemicals & Plastics Corp.
222 Rainbow Blvd. North
Niagara Falls, New York 14302

EX OFFICIO MEMBERS

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Dr. Andrew Robertson
Great Lakes Environmental Research Lab.
National Oceanic & Atmospheric Admin.
2300 Washtenaw Avenue
Ann Arbor, Michigan 48104

Great Lakes Fishery Commission
Mr. Carlos M. Fetterolf, Jr.
Executive Secretary
Great Lakes Fishery Commission
1451 Green Road
Ann Arbor, Michigan 14302

E COVER LETTER AND QUESTIONNAIRE TO AGENCIES

January 24, 1977

Director
U.S. Fish and Wildlife Service
Department of the Interior
Washington, D. C. 20240

Dear Sir:

As required by the Great Lakes Water Quality Agreement of 1972, the Great Lakes Research Advisory Board of the International Joint Commission is engaged in a review of research activities in Canada and the United States concerning the quality of the waters of the Great Lakes.

The attached report entitled: "Great Lakes Quality Research Needs" generated as part of this review, details the issues and research needs identified after extensive consultation with, and input from, the Great Lakes Research community. The report does not consider the current status of research progress or of the resources involved and, in an effort to obtain this information, the Board has approached us to solicit this from the U.S. agencies concerned. The Governments of both the United States and Canada support the Board's efforts to ascertain the degree of responsiveness of the total United States-Canadian program to the needs identified in the report.

We therefore request the cooperation of your agency in the preparation of a survey of ongoing research in both nations pertaining to Great Lakes Water Quality. This survey will assist the International Joint Commission, through the Board, in delineating the extent of the resources being expended on such problems, and will permit the IJC to advise the respective governments of the adequacy of their efforts under the 1972 Great Lakes Water Quality Agreement.

It would be appreciated, therefore, if members of your staff would examine the attached document and identify those components of your research program which relate to the needs therein identified. Although the primary focus is on research efforts specific to the Great Lakes Basin, those programs generating results applicable to the Basin are equally acceptable.

Specific information sought includes:

-- program titles and descriptive narratives;

-- project title listing within programs;

-- pertinence of program to specific water quality problem needs;

-- proposed application of results;

-- identified user groups;

-- estimated time at which results will be available for use;

-- program budget (total and by project if available) for current effort and five-year projection.

In addition, the IJC Board wishes to know the total budget for your water research program in order to evaluate the percentage effort applicable to the Great Lakes Basin.

The enclosed sample form will serve as an illustration of the information requested. Funding and effort information requested can be approximate in order to minimize the time required for you to provide the information.

Subsequent to the receipt of the initial response, additional information or clarification may be requested from your offices or laboratories. The name, title, location, and telephone number of the proper agency representative(s) to contact would be greatly appreciated.

The information requested should be mailed to:

Mr. Karl K. Jonietz, Environmental Officer
Office of Canadian Affairs, Room 5227
Department of State
Washington, D. C. 20520
(Tel: 202-632-1097) (FTS: 632-1097)

Thank you for your cooperation.

Yours sincerely,

John H. Rouse, Jr.
Director
Office of Canadian Affairs

Enclosures:

1. Research Program Information Request
2. Great Lakes Water Quality Research Needs Report

ATTACHED LETTER SENT TO:

Director
U.S. Fish and Wildlife Service
U.S. Department of the Interior
Washington, D. C. 20240

Director
Office of Water Resources Research
and Technology
U.S. Department of the Interior
Washington, D. C. 20240

Director
Geological Survey
U.S. Department of the Interior
Washington, D. C. 20240

Director
Office of Sea Grant
U.S. Department of Commerce
Washington, D. C. 20230

Office of the Administrator
National Oceanic and Atmospheric
Administration (NOAA)
U.S. Department of Commerce
Washington, D. C. 20230

Director
Office of Coastal Zone Management
U.S. Department of Commerce
Washington, D. C. 20230

Office of the Secretary
U.S. Department of the Navy
Washington, D. C. 20350

Office of the Director
U.S. National Science Foundation
1800 G. Street, N. W.
Washington, D. C. 20550

Office of the Administrator
U.S. Energy Research and Development
Administration
20 Massachusetts Avenue, N. W.
Washington, D. C. 20545

Office of the Commandant
U.S. Coast Guard
Department of Transportation
Washington, D. C. 20590

Directorate of Civil Works
U.S. Army Corps of Engineers
Department of Defense
Washington, D. C. 20301

Office of the Administrator
U.S. Environmental Protection Agency
4th and M Streets, S. W.
Washington, D. C. 20460

Office of the Administrator
Agricultural Research Service
Department of Agriculture
Washington, D. C. 20250

cc: L/EUR-MKozak
Interior-RSturgill
EPA-JBlane
IJC-Windsor
IJC-APWatson

IJC GREAT LAKES RESEARCH ADVISORY BOARD'S
RESEARCH PROGRAMS COMMITTEE'S
INFORMATION REQUEST:

GREAT LAKES RESEARCH PROGRAMS

FUNDING AND EFFORT REQUIREMENTS (IN $1,000, MAN YEARS)	FY/76	FY/77	FY/78	FY/79	FY/80
1. Agency					
2. Office/Laboratory					
3. Program Title					
4. Program Narrative					
5. Pertinence to Great Lakes or Rationale					
6. Application and User Group(s)					
7. Result Availability (when will results be available for use)					
8. Project Titles within Programs					
9. Agency Representative: Name, Address & Telephone Number					

AGRICULTURAL RESEARCH SERVICE
WASHINGTON, D.C. 20250
UNITED STATES DEPARTMENT OF AGRICULTURE
OFFICE OF ADMINISTRATOR

FEB 14 1977

Mr. Karl K. Jonietz
Environmental Officer
Office of Canadian Affairs, Room 5227
Department of State
Washington, D.C. 20520

Dear Mr. Jonietz:

This is in response to Mr. Rouse's letter of January 24 and the accompanying report entitled "Great Lakes Water Quality Research Needs." After reviewing the report, we have identified several areas in which we have ongoing related research. We do not have specific research projects located within the Great Lakes watershed, but many of our other projects are producing results that may be directly or indirectly related to some of the research needs listed for the Great Lakes. A list of those research needs is attached.

Due to the broad scope of our programs, it is not practical to try to identify those portions related to your specific research needs. Our research is classified under a system of National Research Programs (NRP). All of our projects related to the listed research needs are included under three of these NRP's. Therefore, we have provided the information you requested for each of these NRP's. We have firm figures only on dollars and manpower for FY-1976, and we have assumed that our effort in FY-1977 will be comparable. We are not in a position to project beyond this. Furthermore, we are attaching a recent progress report for each of these NRP's. These reports indicate both the nature of the work involved and the project locations. More specific information may be obtained from the contact individual listed in the enclosure.

You also requested information related to our total water research programs applicable to the Great Lakes Basin. In addition to the three NRP's listed, we would include three others relating to water-use efficiency, salinity, and irrigation and drainage. The total effort for the six NRP's in FY-1976 amounted to 276.0 SY's and a funding level of $24,007,707. It should be pointed out again that the figures presented represent our total effort. While much of the research listed may be applicable to the Great Lakes Basin, it is not necessarily directly related.

The Great Lakes Research Advisory Board has done an excellent job of assessing problems within the Great Lakes Basin and in identifying the specific research needs listed in this report.

Sincerely,

Ralph J. McCracken
Acting Administrator

7 Enclosures

SPECIFIC RESEARCH AREAS IN WHICH
THE AGRICULTURAL RESEARCH SERVICE HAS RELATED PROGRAMS

ECOL 3 FATES AND EFFECTS OF POTENTIALLY TOXIC ELEMENTS

-6 Identification of the Source Inputs and the Input Quantities of Toxic Elements to the Water Environment

-8 Identification of the Fate of Toxic Elements in the Water Environment

ECOL 7 DYNAMICS OF CONTAMINANTS AND THEIR TRANSPORT

-1 Determination of Contaminant Budgets: Sources, Fluxes, Transformations, and Sinks

-2 Determination of Sediment/Water Exchange

ECOL 17 EFFECTIVENESS OF SEWAGE TREATMENT ON BACTERIA AND VIRUSES

-2 Improvement of Control of Viruses in Sludge

ECOL 20 HALOGENATED PESTICIDES

-5 Determination of the Chemical Fate, Transformation, and Degradation of Halogenated Pesticides

TECH 3 CONTROL OF RUNOFF - RELATED POLLUTION

-1 Assessment of Mass Emission Rates and Source Identification

-2 Evaluation of Structural and Non-Structural Alternatives

TECH 6 SLUDGE HANDLING, UTILIZATION AND DISPOSAL

-1 Evaluation of Regulation and Controls Relating to the Practice of Sludge Utilization on Agricultural Lands

TECH 12 LAND DISPOSAL OF LIQUID EFFLUENTS

-2 Development of Criteria for the Design, Operation and Monitoring of Systems for Land Disposal of Liquid Wastes

IJC GREAT LAKES RESEARCH ADVISORY BOARD'S
RESEARCH PROGRAMS COMMITTEE'S
INFORMATION REQUEST:

FUNDING AND EFFORT REQUIREMENTS	FY/76	FY/77
($1,000)	3,589	$3,589
(Scientists Years)	47.5	47.5

1. Agency

   Agricultural Research Service

2. Office/Laboratory

   See attachment for specific ARS locations

3. Program Title

   National Research Program 20800, Control of Water Erosion, Wind Erosion, and Sedimentation

4. Program Narrative

   The overall objectives of this program are: a) to provide knowledge on methods and systems for better water erosion control; b) to develop conservation systems, tillage methods, techniques, and predictive methods for wind erosion control; c) to develop procedures, techniques, and predictive methods for determining and controlling the yield, transport, and physical-chemical properties of sediment; d) to reduce and control sediment deposition; and e) to develop methods for stream channel stabilization and control of gullies.

5. Pertinence to Great Lakes or Rationale

   Basic principles developed regarding detachment, transport and deposition of sediment could be applicable to areas within the Great Lakes watershed.

6. Application and User Groups

   Scientists and action agencies involved in soil and water management.

7. Result Availability

   These are long range programs. Research results will be published as rapidly as possible.

8. Project Titles within Programs

   1. Improved water erosion prediction and control to preserve and improve productivity of land and prevent water quality degradation;

2. Improved wind erosion prediction and control to protect crops and soils and reduce air pollution;

3. Improved evaluation and prediction of sediment transport, yields, and properties;

4. Improved prediction and control of sediment deposition in reservoirs, valleys, and channels; and

5. Improved stabilization of stream channels and control of gullies.

9. For additional information, contact:

Mr. A. R. Robinson
Staff Scientist, National Program
Staff, ARS, USDA
Room 236, Building 005, ARC West
Beltsville, Maryland 20705

Phone: 301/344-4242

F LIST OF AGENCY REPRESENTATIVES

CANADIAN GOVERNMENT AGENCIES

Representing the Secretary of State for External Affairs

Mr. Sean Brady, Head
Transboundary Environmental Section
U.S.A. Division
Department of External Affairs Canada
Ottawa, Ontario K1A 0G2
Tel. (613) 996-4528

Canadian Federal Government

Agency	Agency Representative
1. AGRICULTURE CANADA	Dr. V. Morley Research Coordinator (Environment and Resources) Research Branch Agriculture Canada K. W. Neatby Bldg., Room 1113 Carling Avenue Ottawa, Ontario K1A 0C6 Tel. (613) 994-5402
2. CENTRAL MORTGAGE & HOUSING	Mr. G. Hill, Secretary Interdepartmental Committee on Municipal Sewage Collection and Treatment Research (SCAT Research Committee) Technology Development Branch Environmental Protection Service Dept. of Fisheries and Environment Place Vincent Massey Ottawa, Ontario K1A 0H3 Tel. (319) 997-3622 also Mr. R. Hébert Director Municipal Infrastructure Division Central Mortgage and Housing Corp. National Office Ottawa, Ontario K1A 0P7
3. FISHERIES AND ENVIRONMENT	
A. Atmospheric Environment Service	Dr. M. Kwizak Director, Air Quality and Inter-Environmental Research Br. Atmospheric Environment Service 4905 Dufferin St. Downsview, Ontario M3H 5T4 Tel. (416) 667-4937

Agency	Agency Representative
B. Environmental Management Service	Dr. G. K. Rodgers Associate Director for Applied Research Canada Centre for Inland Waters P. O. Box 5050 Burlington, Ontario L7R 4A6 Tel. (416) 637-4625
i. Canada Centre for Inland Waters Burlington, Ontario	Coordinator, Director's Office Canada Centre for Inland Waters P. O. Box 5050 Burlington, Ontario L7R 4A6 (Formerly - Dr. W. E. Lowe)
ii. Inland Waters Directorate Ontario Region	Coordinator, Director's Office Canada Centre for Inland Waters Branch P. O. Box 5050 Burlington, Ontario L7R 4A6 (Formerly - Dr. W. E. Lowe)
iii. Great Lakes Forest Research Centre, Sault Ste. Marie, Ontario	J. H. Cayford Director Great Lakes Forest Research Centre Fisheries and Environment Canada P. O. Box 490 Sault Ste. Marie, Ontario P6A 5M7 Tel. (705) 949-8461
iv. Canadian Wildlife Directorate Wildlife Management Branch Ontario Region, Burlington	Dr. D. B. Peakall, Chief Wildlife Toxicology Division National Wildlife Research Centre Fisheries and Environment Canada Ottawa, Ontario Tel. (613) 997-2780
C. ENVIRONMENTAL PROTECTION AGENCY	Mr. J. W. Schmidt Director Wastewater Technology Centre Environmental Protection Service P. O. Box 5050 Burlington, Ontario L7R 4A6 Tel. (416) 637-4374
D. FISHERIES AND MARINE SERVICE	
i. National	Mr. P. S. Chamut Environmental Secretariat Fisheries and Marine Service 615 Booth St. Ottawa, Ontario K1A 0H3 Tel. (613) 992-2547

Agency	Agency Representative
ii. Ontario Region - Great Lakes Biolimnology Laboratory, Burlington	Dr. R. L. Thomas Director Great Lakes Biolimnology Lab. Fisheries and Marine Service P. O. Box 5050 Burlington, Ontario L7R 4A6 Tel. (416) 637-4222
4. HEALTH AND WELFARE	Dr. D. C. Villeneuve Senior Research Toxicologist Bureau of Chemical Hazards Environmental Health Directorate Health Protection Branch Health and Welfare Canada Ottawa, Ontario K1A 0L2 Tel. (613) 992-7758

Ontario Government

Representing the Office of Intergovernmental Affairs of the Ontario Ministry of Treasury, Economics and Intergovernmental Affairs

Miss Karen Junke
External Activities Coordination Secretariat
Ontario Ministry of Treasury, Economics
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5. MINISTRY OF AGRICULTURE AND FOOD	Dr. R. Frank, Director Provincial Pesticide Testing Lab. University of Guelph Guelph, Ontario N1G 2W1 Tel. (519) 824-4120
6. MINISTRY OF THE ENVIRONMENT	Mr. Paul D. Foley Coordinator Development & Research Group Ministry of the Environment Resources Road Rexdale, Ontario M4V 1P5 Tel. (416) 248-3139
7. MINISTRY OF HEALTH	Mr. B. L. Miranda, Chief Public Health Engineering Service Community Health Protection Branch Ministry of Health 15 Overlea Blvd., 5th Floor Toronto, Ontario M4H 1A9 Tel. (416) 965-7678

CANADIAN GOVERNMENT AGENCIES CONT'D

	Agency	Agency Representative
8.	MINISTRY OF NATURAL RESOURCES	Mr. W. R. Foster Acting Assistant Deputy Minister Lands and Waters Ontario Ministry of Natural Resources Whitney Block, 6th Floor 99 Wellesley St. W. Toronto, Ontario M7A 1W3 Tel. (416) 965-4143
9.	ONTARIO HYDRO	Dr. W. A. Effer Environmental Studies and Assessments Energy and Environmental Studies Department Ontario Hydro 700 University Avenue Toronto, Ontario M5G 1X6 Tel. (416) 592-5202

UNITED STATES GOVERNMENT AGENCIES

Representing the United States Department of State

Mr. Karl K. Jonietz
Environmental Officer
Office of Canadian Affairs, Room 5227
Department of State
Washington, D. C. 20520
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United States Federal Government

Agency	Agency Representative
1. DEPARTMENT OF AGRICULTURE	Ralph J. McCracken Acting Administrator
A. Agricultural Research Service	Office of the Administrator Agricultural Research Service U. S. Department of Agriculture Washington, D. C.
2. DEPARTMENT OF THE ARMY	Dr. John Harrison Chief
A. Corps of Engineers	Environmental Effects Laboratory U.S. Army Engineers Waterways Experiment Station P. O. Box 631 Vicksburg, Mississippi 39180
3. DEPARTMENT OF COMMERCE	
A. National Oceanic and Atmospheric Administration	
i. Great Lakes Environmental Research Laboratory	Dr. Eugene J. Aubert, Director Great Lakes Environmental Research Laboratory 2300 Washtenaw Avenue Ann Arbor, Michigan 48104 Tel. (313) 994-3374
ii. Office of Coastal Zone Management	Ms. Eileen Mulaney Regional Coordinator for the Great Lakes Office of Coastal Zone Management National Oceanic and Atmospheric Administration U.S. Department of Commerce 3300 Whitehaven Street, N. W. Washington, D. C. 20235 Tel. (202) 634-4235

Agency	Agency Representative
iii. Office of Sea Grant	Richard C. Kolf, Program Director Grants Management National Sea Grant Program U. S. Department of Commerce National Oceanic and Atmospheric Administration 3300 Whitehaven Street, N. W. Washington, D. C. 20235 Tel. (202) 634-4124
4. DEPARTMENT OF THE INTERIOR A.	Dr. John D. Bredehoeft Deputy Assistant Chief Geologist U.S. Geological Survey Water Resources Division Mail Stop 413 Reston, Virginia 22092 Tel. (702) 860-6971
B. Fish and Wildlife Service Great Lakes Fishery Laboratory	Dr. Joseph Kutkuhn, Director Great Lakes Fishery Laboratory Fish and Wildlife Service U.S. Department of the Interior 1451 Green Road Ann Arbor, Michigan 48105 Tel. (313) 994-3331, Ext. 200
C. Office of Water Research and Technology	Mr. Frank J. Carlson Chief, Biological Sciences Division Office of Water Research and Technology Department of the Interior Washington, D. C. 20240
5. DEPARTMENT OF THE NAVY	Commander Lanny A. Yeske Environmental Service Division Office of the Chief of Naval Operations Department of the Navy Washington, D. C. 20350 Tel. (202) 325-9275
6. DEPARTMENT OF TRANSPORTATION A. Coast Guard	Commandant Coast Guard (9-D/TP 53) Transpoint Building 2100 2nd Street, S. W. Washington, D. C. 20590

UNITED STATES GOVERNMENT AGENCIES CONT'D

	Agency	Agency Representative
7.	ENVIRONMENTAL PROTECTION AGENCY	Conrad O. Kleveno Office of the Administrator U.S. Environmental Protection Agency Washington, D. C. 20460 Tel. (202) 755-8712
8.	ENERGY RESEARCH AND DEVELOPMENT AGENCY	George W. Saunders, Jr. Division of Biomedical and Environmental Research Energy Research and Development Administration Washington, D. C. 20545 Tel. (301) 353-5548
9.	NATIONAL SCIENCE FOUNDATION	Charles C. Thiel Director Division of Advanced Environmental Research and Technology National Science Foundation Washington, D. C. 20550 Tel. (202) 632-4345

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GUIDE TO WATER QUALITY ISSUES *

TECHNOLOGICAL ISSUES

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